

University of Alberta

Health Determinants Associated with the Prevention and Detection of Sexually
Transmitted Infections among Edmonton Street Youth

By

Jennifer J. Gratrix



A thesis submitted to the Faculty of Graduate Studies and research in partial fulfillment
of the
requirements for the degree of Master of Science

Centre for Health Promotion Studies

Edmonton, Alberta

Fall 2003



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Degree: Master of Science

Year this Degree Granted: 2003

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Sept. 10, 2003

Abstract

Objectives: Canadian street youth have been implicated as a core group needing targeted interventions to reduce sexually transmitted infection (STI) transmission. This study sought to understand the health determinants among Edmonton street youth for hepatitis B immunization, agreement to STI/blood-borne pathogens (BBP) testing, and testing positive for STI/BBP.

Method: A convenience sample was recruited from community agencies providing service to street youth. Youth were administered a questionnaire and asked to provide a urine and/or serum sample for STI and BBP testing.

Results: Among the 649 youth, aged 14 to 24 years, the global prevalence of STI/BBP was 11.5%. Logistic regression analyses found environmental, behavioural, and biological factors as significant predictors of health promoting behaviours.

Conclusion: This study confirms that many street youth are participating in high-risk activities for STI/BBP acquisition and have a high prevalence of STI. Street youth are agreeable to outreach services including immunization and STI testing.

Acknowledgments

I would like to thank my thesis committee, Dr. Cam Wild, Dr. Brenda Munro, and Dr. Mark Joffe, for their time, support and involvement in this study. Special thanks to Dr. Wild for taking the lead in this project and providing invaluable feedback.

Thanks to Susanne Shields (Senior Biostatistician) and her team at the Sexual Health and Sexually Transmitted Infections Section, Community Acquired Infections Division, Centre for Infectious Disease Prevention and Control, Health Canada for their support during my participation in the *Enhanced STD Surveillance of Canadian Street Youth*. Also many thanks to Dr. Gerry Predy, Medical Officer of Health for Capital Health, for sharing the data generated from Edmonton's participation in the above study.

I would also like to thank Hannah Pazderka-Robinson for her statistical support with SPSS, a lighthouse in the storm of statistics. And finally, I would like to thank Laurie McCaffrey for providing the listening ear and sound advice of a student who has been through it all.

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Chapter 1

Sexually Transmitted Infections & Adolescent Behaviour

The prevention and elimination of sexually transmitted infections (STI) is a goal that many sexual health professionals strive toward in their daily work. Chlamydia, gonorrhea and syphilis represent 44% of all notifiable diseases in Canada, and 39% of STI are accounted for by genital chlamydia alone (Health Canada, 2000b). Impeding public health efforts to reduce or eliminate STI are core groups or special populations that can be responsible for the perpetuation of disease in their community.

Canadian street youth have been implicated as one of the core groups needing targeted interventions to reduce STI transmission. The exact number of youth living on the streets of urban centres across Canada is unknown, although estimates range from 45,000 to 150,000 youth (Roy et al., 2000). Characteristics of this heterogeneous group include homelessness, unemployment, truancy, criminal activity, substance use, survival sex, and involvement with many governmental systems such as children's services, social services and justice programs (Health Canada, 1998). These characteristics can lead youth to engage in behaviours that may expose them to both STI and blood-borne pathogens (BBP). Once infected with an STI or BBP, behaviours – including multiple sexual partners and injection drug use - can perpetuate the spread of these infections amongst the core group and then to the general population. This reservoir of infection can supercede the abilities of health officials to control or eliminate the infection. Gaining an understanding of the behaviours that perpetuate STI acquisition and transmission among street youth may aid in the development of new health initiatives that

could assist street youth in modifying behaviour that places them at risk for lifelong health consequences.

In order to prevent and control STI in Edmonton, we need to learn more about our street youth population as a core group. Therefore, the overall purpose of this study was to investigate whether social determinants of health among Edmonton street youth predict health enhancing behaviours related to the prevention and control of STI acquisition. The Edmonton subsample from the Enhanced STD Surveillance of Canadian Street Youth study was analyzed to answer the following objectives of this study:

1. To identify differences between a subset of youth who have been immunized against HBV versus those who have not;
2. To identify characteristics of this population which lead to STI/BBP testing;
3. To determine the prevalence of chlamydia, gonorrhea, syphilis, HIV, HBV, HCV, HTLV-I/II and HSV-II among Edmonton street youth;
4. To identify differences between a subset of street youth who have acquired STI/BBP versus those who have not.

Chapter 1 provides the reader with a summary of STI/BBP mechanisms of transmission, health consequences, diagnosis and treatment. As well, chapter 1 reviews theories of adolescent health risk behaviour, focusing on a psychosocial framework in order to set the stage for understanding the complex behaviours associated with STI acquisition among Edmonton street youth. In chapter 2, a systematic review of the literature on street youth and STI/BBP is provided, and chapter 3 outlines the methods to undertake these analyses. Chapter 4 reports results from the study and chapter 5 will conclude with a discussion of the results.

Sexually Transmitted Infections

Sexually transmitted infections (STI) have long plagued humans, with over 20 pathogens identified as transmissible through sexual intercourse. STI remain a major cause of acute illness, infertility, long term disability and even death, and are cited among the top five disease categories for which adults seek health care in the developing world (World Health Organization, 2001). During 1999 alone, 340 million new cases of STI were estimated to have occurred worldwide by the World Health Organization (WHO). These cases tended to occur more frequently among younger aged females, compared to males. The importance of managing STI is highlighted by the economic burden of caring for sometimes preventable and often treatable infections.

STI Caused By Bacteria

Chlamydia. STI can be divided into two broad categories, bacterial and viral. *Chlamydia trachomatis* was first visualized in 1907 by Halberstaeder and Prowazek. *C. trachomatis* didn't receive much attention in the scientific community until a testing method was developed late in the twentieth century that allowed mass screening (Holmes et al., 1999). WHO (2001) estimates that in 1999 there were 92 million new cases of *C. trachomatis* worldwide. *C. trachomatis* is spread among humans through contact with an infected mucosal membrane; this can be through the urogenital tract, the throat and the rectum in both males and females. *C. trachomatis* can also cause infection among newborns in the eyes and lungs. Complications from untreated cases include pelvic inflammatory disease, chronic pelvic pain, ectopic pregnancies, and infertility (WHO, 2001). *C. trachomatis* is curable with antimicrobials including a one-time dose of

azithromycin (Health Canada, 1998) which allows direct observation of treatment and removes concerns of patient compliance with lengthier treatment regimes.

In Canada, *C. trachomatis* first became reportable in 1990, and now accounts for 39% of all notifiable diseases to Health Canada (2000b). Like other STI, prevalence data on *C. trachomatis* is limited to those people who are tested. It is believed that the current rates are an underestimation of the true incidence of *C. trachomatis*, as up to 70% of cases are asymptomatic and therefore people may not access testing (Health Canada, 1998). *C. trachomatis* rates have been declining since first becoming reportable, until recently. Following a record low of 128.8 cases per 100,000 in 1998, *C. trachomatis* rose to 161 per 100,000 in 2001 (Health Canada, 2002c). Canada's national goal for the management of *C. trachomatis* is less than 50 cases per 100,000 by 2010. Women have accounted for 75% of all reported *C. trachomatis* cases with 38% (1063.2/100,000) of female cases in the 15-19 year old age group. Thirty-seven percent (394.1/100,000) of all male cases are among men aged 20-24 years (Health Canada, 2000b).

In Canada, bacterial culture remains the gold standard for testing, with >99% sensitivity and 100% specificity and is often used for medico-legal reasons and when viability issues are not of concern (Health Canada, 1998). Culturing does pose problems for clinical settings in the community, as stringent laboratory and transportation issues make it highly impractical (Holmes et al., 1999). The recent advent of nucleic acid amplification techniques (NAAT) testing, ligase chain reaction (LCR) and polymerase chain reaction (PCR) have provided other options for testing with specificity consistently >99%. With the introduction of LCR and PCR testing, transportation and the ensuing issue of organism viability is eliminated. LCR and PCR can detect both viable and

nonviable organisms. LCR will detect 15-40 percent more infected cases than culture with an increase in overall prevalence by 4-5 percent. Unlike culture, which requires vaginal examination and collection of cells from the cervix, another benefit of LCR and PCR testing is that specimen collection can be obtained from either endocervical cells or urine. This increased ease of sampling allows a much greater range of testing situations outside of the traditional clinical setting. Sensitivities for the different collection types are reported in Table 1 (Holmes et al., 1999).

Table 1-1

Sensitivities of LCR and PCR from First Catch Urine and Endocervical Collection Methods.

	First Catch Urine		Endocervical	
	LCR	PCR	LCR	PCR
Sensitivity	90-96	87-100	81-100	60-92

Gonorrhea. *Neisseria gonorrhea* was first described in 1879 by Neisser and has been curable with antimicrobials since 1936 when sulfonamides were first introduced (Holmes et al., 1999). The WHO (2001) estimates that there were 62 million new cases of gonorrhea worldwide in 1999. Humans are the only natural host for *N. gonorrhea* and similar to *C. trachomatis* requires contact between mucosal surfaces with an infected person (Holmes et al., 1999). Greater than 50% of infected males and females may be asymptomatic and gonorrhea has similar clinical manifestations and complications as chlamydia (Health Canada, 1998).

Canada's national goal for *N. gonorrhea* control is elimination by 2010. *N. gonorrhea* rates experienced a similar trend to *C. trachomatis*, reaching a low in 1997 of 14.9 per 100,000 and a rise since that time to 21.7 per 100,000 in 2001 (Health Canada,

2002c). Age and gender distributions are also similar with the highest rates (80.2/100,000) in 15-19 year old females and (64/100,000) in 20-24 year old males (Health Canada, 2000b).

With low case numbers of gonorrhea, the Laboratory Centre for Disease Control recommends interventions that move away from broad-based strategies to community level programs targeting specific core groups. Core transmitters are people practicing high-risk activities who are more likely to become infected than the general population (Holmes et al., 1999); discussion of core transmitters will be provided in a later section. The collection of urine specimens and the utilization of NAAT testing allows testing to be moved to nontraditional settings to reach these groups. NAAT testing also allows molecular mapping of disease transmission through sexual networks distinguishing between endemic and imported cases (Peeling & Ng, 2002).

One disadvantage of moving solely to NAAT testing for gonorrhea is the current inability to perform susceptibility testing of gonorrhea isolates to antibiotics, an important tool in disease control. Many areas around the world have gonorrhea isolates that are resistant to penicillin and tetracycline, antibiotics common and affordable to developing nations (WHO, 2001). Fluoroquinolone resistance has also been reported across Southeast Asia (Health Canada, 2000b) and has been identified in Canada (Peeling and Ng, 2002), affecting the health care providers' treatment options as a single-dose of Ciprofloxacin is one of the current treatment recommendations (Health Canada, 1998). Without the ability to test for sensitivities, resistant strains of gonorrhea would be undetected and cases may receive inadequate treatment.

Due to this need for susceptibility testing in the control of gonorrhea, culture remains the gold standard for testing and is preferred whenever there is a question of resistance. The ideal conditions for successful recovery of *N. gonorrhea* isolates is to be plated on a Thayer-Martin medium and grown at 35-37°C in a 5% CO₂ atmosphere, providing a sensitivity of 80-95%. Due to the impracticality of every collection facility having access to and maintaining a CO₂ incubator, the development of LCR and PCR testing for gonorrhea has been helpful (Holmes et al., 1999).

Syphilis. Syphilis is one of the oldest STI, being first described in the 16th century (WHO 1997). Syphilis rates peaked after the Second World War and have since been declining, with WHO (2001) estimates of 11.76 million new cases worldwide in 1999. "Syphilis is the classic example of a STI that can be successfully controlled by public health measures due to the availability of a highly sensitive diagnostic test and a highly effective and affordable treatment" (WHO, 2001, p.21).

Syphilis is a chronic and systemic infection with periods of clinical disease and latency (Holmes et al., 1999). Primary syphilis begins with a painless ulceration (chancre) at the site of inoculation in the uro-genital tract, rectum or mouth within 2 to 6 weeks of contact (Holmes et al., 1999). Syphilis can then progress to secondary syphilis with symptoms developing up to six months after the chancre has healed. The causative agent, *Treponema pallidum*, disseminates through the body manifesting itself as cutaneous lesions, characteristically on the soles of the feet and palms of the hands, mucosal lesions (condyloimata lata), and generalized malaise (Holmes et al., 1999).

If left untreated, symptoms will have cleared but the person's serology will remain reactive and the infection moves into a period of latency. The infection is

classified as early latent syphilis during the first year post infection and from there the infection progresses to late latent syphilis. Clinical manifestations during this time may include complications in pregnancy such as wastage and transmission to the fetus (congenital syphilis), musculo-skeletal, cardiovascular, and nervous system disorders. Syphilis is curable during any of the stages of infection with a series of penicillin G injections (Holmes et al., 1999).

Testing for syphilis is easily done through serology. Generally the initial screening serology includes a rapid plasma reagin (RPR) which is measured in dilutions. Dilutions increase during primary syphilis (1,2,4,16,64...) and decrease with treatment or as the disease progresses (64,16,4,2,1). The second serological test is the *Treponema pallidum* particle agglutination test (TP-PA); this will often remain reactive for the rest of the individual's life. The third serological test is the fluorescent treponemal antibody absorption test (FTA-ABS); this is the most sensitive and first to become reactive when infected. It may also remain reactive for life (Health Canada, 1998).

Syphilis has been notifiable in Canada since the 1940's with rates declining to near elimination. The national goal for syphilis is $<0.5/100,000$ (Health Canada, 1997a) with regions of Canada declared "syphilis-free" zones experiencing 3 or more years without a syphilis case. Recent outbreaks in sub-populations across Canada have attributed to a recent rise in rates. Since 1994, the average rate of 0.4-0.6/100,000 has risen to an expected rate of 0.9/100,000 in 2001 (Health Canada, 2002a).

A sub-population has been affected by a recent outbreak in Vancouver's downtown eastside, experiencing syphilis rates of more than 150/100,000 and a concurrent rise in *N. gonorrhea* (Health Canada, 2000c). This core group is characterized

by heavy alcohol and injection drug use creating severe social problems (Health Canada, 2000c). Most (69%) of the acquired cases were related to the sex trade, 42% were street workers and the remainder were paying or non-paying sexual contacts (Health Canada, 2000c). Alternate strategies for managing this outbreak were used to reach these core transmitters. Health officials utilized street nurses who were providing outreach health services to this population, to deliver over 7,000 treatment doses for syphilis to the at-risk populations in the downtown east-side. In a final effort to aid in treatment coverage of this hard-to-reach population, the program used another strategy, a "secondary carry". This strategy involved providing a treatment dose to the client to take to friends not accessing the outreach programs (Health Canada, 2000c).

STI Caused by Viruses

Human Immunodeficiency Virus (HIV)/Acquired Immunodeficiency Syndrome (AIDS). HIV was identified in the early 1980's, when healthcare providers investigated several cases of immunosuppression among homosexuals with Kaposi's sarcoma and *Pneumocystis carinii* (now AIDS defining syndromes; Holmes et al., 1999). The HIV virus was then linked as the causative agent leading to AIDS. WHO estimates more than 60 million people have been infected since the epidemic began two decades ago, with heterosexual transmission causing the greatest concern for the worldwide spread (WHO, 2001). HIV is also infecting the world's youth, with WHO (2001) estimating that 11.8 million youth aged 15-24 years are living with HIV/AIDS.

HIV is transmitted through body fluids, particularly blood, semen, vaginal fluids, and breast milk. Transmission of the virus is dependent upon the concentration of virus and the nature and duration of the contact. Viral burden is the highest at the time of

infection and with advanced disease, and at these times an infected person is highly infectious. During seroconversion, people may experience a mononucleosis-like illness, including lymphadenopathy, rash, malaise, fever, and diarrhea. Viral load then drops, as one remains asymptomatic for 5-8 years. Viral loads then rise again as the disease progresses to AIDS, where the person contracts AIDS related illnesses including opportunistic illnesses, such as *Cryptosporidium* and *Pneumocystis carinii* (Holmes et al., 1999).

Testing for HIV has been available in Canada since 1985. HIV testing is available through physicians, community health centres, STD clinics and nursing stations using a combination of non-nominal, nominal and anonymous testing across the provinces and territories (Health Canada, 2001c). In Canada, testing for HIV is done through serology. An enzyme immuno assay (EIA) screening test is completed on all blood for the antibody to HIV 1 & 2. A positive EIA is confirmed by the Western Blot before a positive result is reported. Because testing is done by measuring the body's response to the HIV virus through antibodies, window periods (times between exposure and positive test results) are created. Using the current testing method, Anti-HIV is detectable in 97% of cases within a three-month window period and detectable in 99% of cases within six months (Health Canada, 1998).

All HIV/AIDS data are limited by reporting delays and account for only those people who come forward for testing and those who seek medical care (Health Canada, 2003b). In addition, while AIDS has been reportable in Canada since its recognition, positive HIV results became reportable more recently with some provinces reporting earlier than others. Because of these limitations, the true prevalence of HIV/AIDS in

Canada is unknown. The Bureau of HIV/AIDS, STD & TB estimated that at the end of 1996, 49,800 Canadians were living with HIV, and 15,000 of those Canadians were unaware of their HIV infection (Health Canada, 2001d). Since becoming reportable, 52,640 positive HIV tests have been reported. The number of HIV positive tests reported per year has declined by 30%, from 2,985 in 1995 to 2,120 in 2000 (Health Canada, 2003b). The age groups most affected by AIDS are the 30-39 year olds (39.2% of reported AIDS cases in 2002). Due to the prolonged time from infection with HIV to the onset of AIDS, the age of infection is estimated to be during the 20-29 year range. In total, 69.5% (11,748 cases) of Canada's total AIDS cases reported are deceased. The death rate from 1995-1999 has dropped 92.5%. Factors related to this drop include the impact of effective and accessible anti-viral treatments (Health Canada, 2000a).

Initially, HIV predominantly affected men who have sex with men (MSM) and recipients of blood products. However, injection drug use (IDU) now accounts for 23.6% of HIV infections acquired in 2002. A similar shift has occurred in AIDS data where MSM as a risk behaviour has decreased steadily to 39.2% in 2002, while IDU has increased from 2.7% between 1979 to 1993 to 22.2% in 2002 (Health Canada, 2003b).

Other shifts in the epidemiology of HIV infection include a rise in HIV and AIDS among women. Cumulative HIV rates in women rose from 14.3% in 1985 to 25.4% in 2002 (Health Canada, 2003b). Of special concern is that the highest proportion of female adult AIDS cases are among women of childbearing age, 15-29 year olds, accounting for 43.8% of adult AIDS cases (Health Canada, 2002b). As well, the heterosexual exposure category has risen from 8.2% of cases in 1985 to 29.9% in 2002 (Health Canada, 2003b). Health Canada (2002b) reported that 79% of cumulative pediatric AIDS cases are

attributable to perinatal transmission. Success in reducing perinatal transmissions has been demonstrated through prenatal HIV screening, early initiation of therapies against HIV and counseling of mothers on infant feeding. These strategies have received overwhelming support from Canada's medical community (Cote & Halperin, 2002).

Another population that is of concern is the over-representation by Canada's Aboriginal people in HIV statistics. Aboriginal people (First Nations, Inuit and Metis) represent 2.8% of the Canadian population, but accounted for 10.7% of AIDS cases in Canada in 1999, a notable rise from 1.7% in 1992 (Health Canada, 2003b). Aboriginal people are also over-represented in risk behaviours associated with HIV infection, with IDU accounting for 34% of cases during 1996-2000 as compared to 5.9% in non-aboriginal people. As well, higher numbers of Aboriginal women (22.7% versus 7.9% non-Aboriginal) and youth under 30 years of age (25.9% versus 16.7%) are reported in AIDS cases. Recent data from Northern Alberta and the North West Territories illustrate the concern. Of 32 HIV positive women who delivered in 1996-1998, 29 (91%) were Aboriginal (Health Canada, 2001b).

Genital Herpes. The herpes virus has been described for over the past 25 centuries, being endemic among human hosts as it is carried by a large percentage of the population. In the 1960's, researchers identified subtypes, HSV-1 and HSV-2, of the herpes virus. HSV-1 is most often found isolated from facial lesions while HSV-2 is most often isolated from genital lesions, though recent trends in sexual practices have found this to be far less exclusive. Transmission of the herpes virus is through intimate, often sexual, contact with the site of infection and mucosa or abraded skin. Much different than the bacterial STI, HSV is incurable and infected people become long-term

carriers and reservoirs of infection, shedding the virus when pressures are placed on their immune systems (Holmes et al., 1999).

The disease course includes a primary eruption of painful vesicles at multiple genital sites with accompanying lymphadenopathy. Ultimately the person's immune system will triumph and the virus will move into latency, harboured in the ganglia of nerves innervating the site of infection. Often the cycle recurs, though scientists are unsure of what initiates a reactivation of the virus. For people suffering from frequent or severe recurrences, antiviral therapies are available for symptom management (Holmes et al., 1999).

The standard testing for HSV is a culture, with the ability to type between HSV 1 & 2 and >99% sensitivity and 100% specificity (Health Canada, 1998), although the sensitivity of the culture declines as the sore begins to heal (Centers for Disease Control and Prevention, 2002). The success of the culture method is dependent on how and when a specimen is collected. Serology testing for HSV is available but is generally reserved for research. A positive serological result will tell the patient about his or her HSV status but not about recent infection or the site of infection (Health Canada, 1998).

The Canadian prevalence of herpes simplex virus (HSV) is not well known as there is no national reporting system. Two studies, cited by Health Canada (1997), provide insight into prevalence in study populations:

In an unpublished study by Sacks in 1987, the HSV-2 seroprevalence of pregnant women in Vancouver ranged from 4.6% in those with only one partner to 55% in those with more than 10 partners. Western blot test was used. The second study by Rawls, done on an unspecified population in Toronto, showed by neutralizing

antibody that 17% of women and 12% of men were HSV-2 positive (Steben & Sacks as cited in Health Canada, 1997a, Genital Herpes section, ¶ 5).

Human Papillomavirus (HPV). Written about since the first century AD, HPV is very widespread and causes warts in a variety of locations. Anogenital warts (condyloma acuminata) is the most common viral STI (Holmes et al., 1999). Health Canada (1998) estimated that 10 to 30% of the adult population is infected with HPV, many subclinical. Because of the large population based prevalence, HPV does not require a core group to sustain its transmission like gonorrhea and syphilis. HPV is also responsible for the second most frequent carcinoma, cervical carcinoma, in women worldwide (Schneede, 2002).

Ano-genital HPV is transmitted primarily through sexual contact and manifestations include condylomatous, papular or flat aceto-white lesions. HPV can be detected through visual exam or on pap screenings found as squamous intraepithelial lesions (SIL), with high grade SIL representing possible early development of invasive cervical cancer. No treatment guarantees cure (Health Canada, 1998), and often the virus will be cleared spontaneously within 6-12 months post infection (Schneede, 2002). Many people though do choose treatment as people find the warts visually unappealing. In addition, as well removing the wart may reduce the amount of virus and could potentially reduce the risk of transmission to others. Treatment is available as patient applied or provider-applied. Patient applied options include Podofilox 0.5%, which is an antimitotic agent or imiquimod, which stimulates the immune system to fight the virus. Provider applied therapies include cryotherapy, destruction of the wart by freezing, or surgical

removal. All treatments require patience and multiple treatments (Holmes et al., 1999; Health Canada, 1998).

HPV is another STI that is not a reportable disease in Canada. Health Canada (1997a) estimates the prevalence to be 2% among sexually active women. A recent study of 1004 women in Ontario reported a somewhat higher rate among its study population. Participants were randomly chosen from six health regions while accessing their primary care physician for a pap smear. From the 955 samples tested with the hybrid capture II test, the highest prevalence (24%) was found in the 20 to 24 year old women and declined to 3.4% in women 45-49 years olds. The authors also found a strong association between HPV and abnormal cervical cytologic results (Sellors et al, 2000).

Health Canada (2000b) reports that over the last four decades, the incidence of invasive cervical cancer has been halved with the use of pap smears. Still, subpopulations including Saskatchewan Indians, the Canadian Inuit, and recent immigrants, have a prevalence higher than the national average (Sellors & Lytwyn as cited in Health Canada, 1996).

Viral Hepatitis. Another ancient disease is viral hepatitis, most commonly differentiated into Hepatitis A virus (HAV), Hepatitis B virus (HBV), and Hepatitis C virus (HCV). In Canada in 1995, 7.1/100 000 cases of HAV were reported, with the most common risk factor for transmission being fecal-oral spread and food handling (Health Canada, 1998). 50% of persons infected with HAV develop acute symptoms of low grade fever, malaise, headache, myalgia, anorexia, nausea and vomiting, dark urine and jaundice. In time HAV infection will resolve and past infection will be marked through a

positive serological test of antibodies to HAV (Holmes et al., 1999). HAV is a sexually transmitted infection primarily among MSM.

HBV remains the most common viral hepatitis globally and remains a major cause of morbidity and mortality (Tepper & Gully, 1997a). The World Health Organization (in Tepper & Gully, 1997b) estimated that 350 million people are chronically infected, over four million new cases of acute infection are occurring annually, and one million deaths can be attributed to HBV. HBV has been reportable in Canada since 1969 with an estimated incidence of 2.3/100,000 or approximately 700 cases per year. The highest incidence of HBV is in the 30-39 (6.1/100,000) years of age group followed by youth 15-29 years (2.7/100,000) (Zhang, Zou & Giulivi, 2001).

HBV is spread through contact with infected blood (such as sharing injection equipment for drug use, tattooing or piercing), perinatal and childhood horizontal transmission and sexual intercourse. In Canada, 45% of new cases are due to sexual contact (Health Canada, 1998). HBV infects liver cells and may cause symptoms of fatigue, malaise and jaundice, although many people infected with HBV are asymptomatic (Health Canada, 1998). The progression to chronic (carrier) infection may lead to long-term sequelae such as cirrhosis and hepatocellular carcinoma. Becoming a carrier of HBV is inversely related to age; those infected in the first year of life will have a 90% chance of progressing to the carrier state while only people infected with HBV as adults have a 5% chance of becoming carriers (Tepper & Gully, 1997a).

HBV is the only STD preventable by vaccine and is the first routinely used vaccine that will also prevent hepatic cancer. Provincial and territorial health care programs have targeted HBV immunization programs at individuals recognized as high

risk, such as hemophiliacs, health care workers and intravenous drug users (Zhang, Zou, & Giulivi, 2001). Current screening of blood donations and widespread promotion of universal precautions for contact with body fluids, make transmission of HBV in Canada primarily through sexual contact (Tepper & Gully, 1997b). One public health strategy used to reduce the incidence of HBV is a universal pre-adolescent immunization program (Zhang, Zou, & Giulivi, 2001).

Hepatitis C (HCV) was first identified in 1989 as the cause of most cases of post-transfusion non-A non-B hepatitis. HCV, in contrast to HAV and HBV, causes persistent infection with 85% of those infected becoming chronic carriers leading to a risk of cirrhosis, liver disease and death (Canadian Communicable Disease Report [CCDR], 1999). The CCDR (1999) reported an estimated 3% of the world's population are infected, serving as a reservoir for further transmission. In Canada, national reporting began in 1992 and estimated a 0.8% prevalence rate with only 30% of cases aware of their HCV positive status. HCV is detected through a serological test for antibodies to the virus. The difficulty with this test is that it can only measure the prevalence of the disease and not date the time of disease acquisition. Epidemiologists are then unable to determine if the case was a recent infection or a past infection (Health Canada, 1998). Before 1990, 10-15% of HCV infections were from unscreened blood products, while 70% of recent infections are accounted for by IDU (CCDR, 1999). Sexual transmission is a very uncommon route of HCV acquisition.

Human T lymphotropic virus I/II (HTLV). HTLV-I was the first human retrovirus isolated in 1980. HTLV-I is endemic in southern Japan, the Caribbean, and some parts of Africa and South and Central America. This virus causes at least two types of disease: 1)

adult T-cell leukemia/lymphoma and 2) tropical spastic paraparesis/HTLV-I associated myelopathy. HTLV II was then isolated in 1982, but much less is known regarding its disease association. HTLV-II has been found among injection drug users and their sexual partners (Liu et al., 1999). Transmission of both types of the virus occurs in three ways. First, breast-feeding beyond six months of age (due to the decline in protective maternal antibodies) has led to transmission. Secondly, sexual intercourse transmits the virus frequently from men to women but rarely from women to men. Thirdly, the most efficient mode of transmission is through contaminated blood products (Tsukasaki, Koeffler, Tomonaga, 2000). Although a vaccine or treatment is not available, success in containing the rise has occurred through information campaigns around breast-feeding and screening of blood products (Bangham, 1999).

STI Control and Prevention

Despite the fact that many STI are curable with appropriate antimicrobial treatment, STI still cause considerable public health concerns in developing and industrialized countries (WHO, 2001). There remain many reasons why people do not seek treatment, even in countries where national programs are in place to provide free access to testing and treatment. In many cases of STI, people are asymptomatic and therefore are unaware of the need to seek treatment. Others may experience social stigma attached to utilizing services for STI and testing positive for the same (WHO, 2001). As well, health practitioners may be limited in their abilities to do appropriate partner notification, leaving people unaware that they may need testing.

Health Canada has set national goals for elimination and reduction of STI, but recent resurgences of pockets of disease pose challenges to these goals. From the

epidemiological picture of Canadian STI rates presented earlier, it is evident that STI prevention and control is very complex with programs needed specifically for marginalized populations who are not being effectively reached through current programs (Maticka-Tyndale, 1997). Socioeconomic disparities, ethnicity differences, and the recognition of core groups serving as infection reservoirs are important program considerations (Maticka-Tyndale, 1997). Health care professionals examining these resurgences recommend that future elimination strategies will need to be community level interventions targeted at core groups that participate in high-risk behaviour (Peeling & Ng, 2002).

Core Transmitters. Three perspectives define the concept of core transmitters in STI prevention and control: mathematical, clinical-epidemiological, and sociocultural. The mathematical approach in studying core groups began with work by Yorke and his colleagues in the 1970's (Thomas & Tucker, 1996). They began an epidemiological shift in STI prevention that moved from looking at the risk of acquiring an infection to how the infection is transmitted. In this perspective, the spread of STI are influenced by three factors; transmission efficiency (β), the rate at which sexual partners change (c), and the duration of infectivity (D). This spread can be captured in the following equation: $R_o = \beta c D$, where R_o is the average number of new infections generated by the original case or the case-reproduction ratio (Thomas & Tucker, 1996; WHO, 2001). A R_o of >1 is required to maintain the STI. When R_o is >1 among core groups and members mix with the general population, the epidemic state moves from among the core group to an endemic state among the general population. Theory would then suggest if you can

decrease the R_0 in the core group the endemic transmission would cease and the infection would become extinct (Thomas & Tucker, 1996).

This equation highlights both the biological and behavioural components of STI transmission. Brunham (1997) points out that the behavioural component has a higher degree of variability than the biological components. By rearranging the equation, a threshold of partner change (C_T) can be determined for creating an endemic state:

$C_T = 1/\beta D$. With available estimates for β & D for chlamydia and gonorrhea, Brunham reports that four new partners per year would sustain an endemic state.

This mathematical model has several limitations. First, the model does not provide us with access to the target group, which is needed for programming. Secondly, the model simplifies complex behavioural determinants of transmission into one measure. For example, STI transmission can not be explained with an individual-based model, as transmission requires the intimate interaction between two people. As well, situational factors impact the three measures. For instance the period of time an individual is infectious can be lengthened with limited access to clinical services and can be shortened with new one-dose treatment regimens (Thomas and Tucker, 1996).

Thomas and Tucker (1996) describe a second approach to understanding the core group concept, clinical epidemiological examination of repeat infections. This technique is generally used in clinical practice; identifying individuals with repeat infections during a given time frame, such as having more than one case of gonorrhea in a year period. Different from the mathematical model that identifies a target group, this model focuses on people accessing clinical services who are accessible to the health care provider for an intervention. This model also allows health care practitioners to identify geographical

clustering of cases through client demographics. One limitation of the model is that it solely captures diagnosed cases and misses cases not presenting for clinical services. As well the model includes individuals who are positive but not at risk for transmitting an STI (they have only one partner; Thomas and Tucker, 1996).

The final approach that Thomas and Tucker (1996) describe is the sociocultural approach to core groups. This approach focuses on groups of people deemed high risk in the community where their normative behaviours place them at risk, for example prostitutes. Often referred to as hard to reach, they are recruited in the community rather than a clinical setting. Strategies associated with this model may include mass screening for STI at a crack house.

One limitation of this approach is that all group members are labeled as participating in high risk activities when some members may not, placing challenges on any attempt to define the group. Also complicating the issue is the difficulty STI present in defining high risk behaviours, as unprotected sex between two individuals is only high risk if one partner is infected, therefore the risk is based on the prevalence of the infection in that community (Thomas and Tucker, 1996).

Gunn, Fitzgerald and Aral (2000) suggest that controlling STI among core groups can markedly impact a community's incidence of STI. Prevention of STI occurs at different levels. Primary prevention includes strategies such as health education, promotion of safer sex and condoms, risk reduction and information campaigns (WHO, 2001) including STI symptom recognition (Gunn, Fitzgerald & Aral, 2000). Secondary prevention includes promoting health seeking behaviours and accessible care (WHO, 2001). Successful STI control also includes rapid treatment of symptomatic individuals

and periodic screening of asymptomatic individuals, thereby shortening the time of infectivity. Increasing public access to appropriate STI testing and treatment sites for at-risk populations may involve the development of more outreach settings based on the sociocultural approach. Many urban centres in Canada already have examples of outreach services in various forms such as needle exchange programs.

Previous population-based primary prevention programs spread the costs of behaviour change over the population with everyone receiving the benefits of STI prevention. A primary prevention program targeted to subpopulations decrease the costs associated with behaviour change from the entire population and places the cost solely on the subpopulation. Aral, Holmes, Padian & Cates (1996) question the fairness in asking subpopulations to pay the entire cost when they are often challenged with many of societies costs with the least resources. As well concerns exist about labeling subgroups and the subsequent creation of "public health dragnets" (p.S132).

The concerns about labeling core group membership may lead to a shift towards "risk situations" defined by economic or political situations (Aral, Holmes, Padian & Cates, 1996). Thomas and Tucker (1996) suggest utilizing an ecological framework in future work to enhance our understanding of the multiple determinants of health related to STI acquisition. The first level to consider is intrapersonal factors such as an individual's knowledge, beliefs and attitudes about STI testing and prevention. Another level refers to institutional factors, including access to healthcare and the availability of clinic hours. Other levels include community competence and national laws and policies (Thomas and Tucker, 1996), such as support for needle exchanges from local police and justice departments.

Sexual Networks. A more recent strategy in identifying core groups is the utilization of sexual network analyses. STI are not transmitted randomly but are dependent on social mixing that create sexual networks. Large sexual networks contain core groups, who transmit a STI to their partners, who transmit the STI to their partners, and this continues until a large network is established. With a high rate of connectivity they provide the STI with numerous opportunities for spread (Wylie & Jolly, 2001). Sexual networks are derived from interviewing individuals who are positive with a STI for their sexual contacts and their nonsexual contacts, as these persons may be infected but not by the interviewed case. It is the links that connect individuals, how closely the interconnectedness is and how central a person is to the network that will determine their risk of STI acquisition (Day, Ward, Ison, Bell & Weber, 1998). Therefore, authors suggest that stopping transmission of a STI in the large network and among people with multiple exposures is more effective than mass prevention strategies (Jolly & Wylie, 2001; Rothenburg, 2002).

Theories of Adolescent Health Risk Behaviours

The previous section highlights the behaviours that are implicated in STI acquisition. The following section reviews the concept of risk as it relates to behaviours and then reviews theories of adolescent health risk behaviour. The literature on theories of adolescent risk behaviour is extensive and continues to grow. The theories reviewed in this section examine risk behaviour from an individual level and in relation to psychosocial characteristics of youth. There are limitations in the generalization of findings due to the diversity in individuals and families as well as communities and socio-cultural settings (Lerner, Lerner, SeStefanis, & Apfel, 2001). For example, many of the studies

using ethnicity as a variable were conducted in the United States and did not include ethnic categories (e.g. Aboriginal) that would be relevant to Canada. As well, many studies on adolescent risk behaviour use surveys that lack explicit theoretical underpinnings. Many of the theories point to the interrelatedness of problem behaviours, suggesting that for health care professionals to be successful they need to broaden their focus rather than focusing solely on one behaviour.

Adolescence, once characterized as a period of "storm and stress", is a time of major challenges to youth in their safe development into healthy productive adults. Many adult health beliefs and behaviours are shaped during adolescence (Maddux, Roberts, Sledden & Wright, 1986). Challenges faced during adolescence include experimentation with drug and alcohol use, delinquency, cigarette smoking, and risky sexual behaviour, as adolescents try on the identities of adults (Thomas, Reifman, Barnes & Farrell, 2000). Brook & Brook (1990) suggest that adolescents are particularly vulnerable due to "the transitional and fluctuating nature of their emotions, defense mechanisms, and personality" (p.117). Unfortunately, some of the consequences of these behaviours are lifelong and affect the health of the country (Fahs et al., 1999). Through the study of risk behaviour patterns, prevention programs can be planned (Goodson, Evans & Edmundson, 1997).

Risk

Health Canada (1997b) defines risk as "the likelihood or the probability of experiencing some type of harm, or losing something that one values" (p.3). The concept of risk originated from the field of epidemiology, in the search for factors that prevent morbidity and mortality among the population (Health Canada, 1997b; Jessor, 1992).

Risk factors may be biological, environmental or psychosocial variables or characteristics "that when associated with an individual will place them at greater likelihood of developing a problem" (Health Canada, 1997b, p. 4). Risk factors can be both internal (heredity, biological, or behavioural) and external (environment, socioeconomics, or demographics), with multiple risk factors having a cumulative effect.

Risks are dependent on the individual's developmental stage, as one's understanding of risk changes with age. Certain risk behaviours may serve important social and personal functions for adolescents in their development while being harmful at the same time (Jessor, 1992). For example, not all outcomes of risk behaviours are aversive. During adolescence, smoking marijuana may provide the youth with positive outcomes like social acceptance by peers and a sense of autonomy from parents (Health Canada, 1997b; Jessor, 1992).

Risk also operates on a social continuum ranging from what society determines as an inevitable risk, to acceptable risks, to risks that are unacceptable. This continuum is based on social norms embedding risk behaviours in social context and making them fluid as times change. The association of risk with social norms introduces a bias in what society determines as "normal" behaviour (Health Canada, 1997b). Similar to concerns expressed about core groups, adolescent risk behaviours are embedded in structural inequities, such as poverty, that may be beyond the control of the individual making resources to deal with risk inequitably distributed (Health Canada, 1997b; Lerner et al., 2001).

Lennings (1996) reminds us that despite the numerous challenges faced by adolescents, 80% of youth make it through this transition to become healthy productive

members of society (Lerner et al., 2001). The remaining 20% of adolescents experience some form of health harming behaviour, such as illicit drug use, cigarette smoking, or early onset of sexual behaviour. So how do adolescents battle against the risk and challenges of growing up? The literature outlines another key concept to consider when discussing risk, and that is protective factors. Protective factors moderate or buffer the impact of risk factors on adolescents (Jessor, 1992). Protective factors include social and perceived environment, behaviour and skills, personality, and family (Health Canada, 1997b; Jessor, 1992).

Individual Context

Development. No other time in the life span presents as many developmental challenges to behaviour as adolescence. To understand the challenges that adolescents face, it is helpful to outline the developmental tasks of moving into young adulthood and developing autonomy from parents. Wagner (1996) identifies six interacting domains of change: biological, cognitive, emotional, social, moral and vocational. Identifying criteria for optimal development across the six domains provides goals for health care professionals when working with youth on developmental issues. Optimal biological development is achieved by reaching a healthy, physical maturity while engaging in health enhancing behaviours. Common detriments to healthy biological development include cigarette smoking, alcohol use, and illicit drug use. Cognitive development involves the movement from concrete to abstract thinking, increased speed in processing information and the development of a greater knowledge base, allowing adolescents to develop an awareness of long term consequences of their actions.

Wagner (1996) characterizes emotional development as an increase in awareness, feelings of security and self-confidence, as well as the development of resilience. Supportive and continuous relations with parents is key to healthy development (Wagner, 1996; Lerner et al., 2001). Social development increases skills needed for the development of trusting relationships demonstrating the importance of friendships. Adolescents may struggle with issues of sexual orientation and gender-roles at this time.

Moral development involves the development of an abstract set of moral principles involving fairness and equity, with an awareness of moral knowledge, social convention and prosocial behaviours. Finally, vocational development involves developing employability skills.

Individual health behaviour and decision-making models. Individual health behaviour theories, including the health belief model (HBM) and the theory of reasoned action (TRA), have a long history of application to adolescent and adult risk behaviours. These theories focus on the individual's knowledge, attitudes and perceptions of the risk behaviour, attempting to anticipate negative health outcomes and how to avoid or mitigate the effects (Weinstein, 1993). Negative health outcomes are expected to motivate the individual to perform health-enhancing behaviours. The theories have been tested extensively on adults as assumed rational decision-makers. Critics have argued that in many cases adults are unable to make rational decisions, so we can expect the same of adolescents (Maddux et al., 1986). A short synopsis of HBM and TRA theories is included here, due to their long history of use in health education, as well as a short review of Prototype-Willingness and Prospect theories.

Health belief model. The HBM is a value-expectancy theory proposing that the desire to avoid illness coupled with the belief that behaviour is available to reduce the health threat will create behaviour change. An example is the value an adolescent places on avoiding infection with a STI, coupled with the use of condoms as a means to reduce the STI threat, encourages youth to have protected sex. HBM includes mitigating constructs such as personal susceptibility to and severity of illness, perceived benefits and barriers of advised health action, cues to action and the likelihood of being able to reduce health threat (see figure 1; Rosenstock & Strecher in Glanz, Lewis & Rimer, 1997).

The strength of the model is the construct of perceived barriers as a strong predictor of barriers to change across behaviours and studies (Rosenstock & Strecher in Glanz, Lewis & Rimer, 1997). The inclusion of modifying factors such as age, sex and socio-economic status attempt to include factors that are intrinsic to the individual and that are repeatedly found as predictors of risk behaviour through prevalence studies. Limitations of the theory in adolescent risk behaviour are possible missed situational constructs such as adolescents from a higher socio-economic group having different resources available to them which may influence their likelihood towards behaviour change compared to adolescents from lower socio-economic groups (McDermott, 1998).

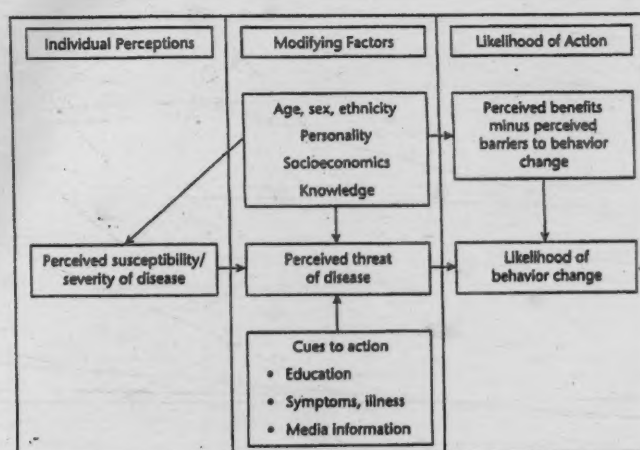


Figure 1. Health belief model components and linkage (Strecher & Rosenstock in Glanz, Lewis & Rimer, 1997).

Theory of reasoned action. TRA is another empirical model linking behaviour through beliefs, attitudes, subjective norms and intentions (see figure 2; Fishbein, Middlestadt & Hitchcock, 1994). Health researchers have used and tested TRA across a variety of health behaviours including smoking, drinking, attending treatment programs, using contraceptives, and safer sex (Fishbein et al., 1994; Greene & Hale, 1997; Wulfert & Wan, 1995; McDermott, 1998). A health protective behaviour is determined by the intention to perform it. Intentions are shaped by both a person's attitudes, the anticipated positive or negative outcomes and the weight applied to that evaluation, and the subjective norms, influenced by the referent's approval or disapproval of a behavior weighted by the motivation of the participant to comply (Montana, Kasprzyk, & Taplin in Glanz, Lewis, & Rimer, 1997). Behaviour change, therefore, is based on altering these underlying beliefs. Using the same example as in HBM, researchers hypothesize that if the adolescent believes that important others support condom use (subjective norms) and

the adolescent anticipates positive outcomes from the use of condoms (attitudes), this creates intentions to use condoms, which will lead to condom-use behaviour.

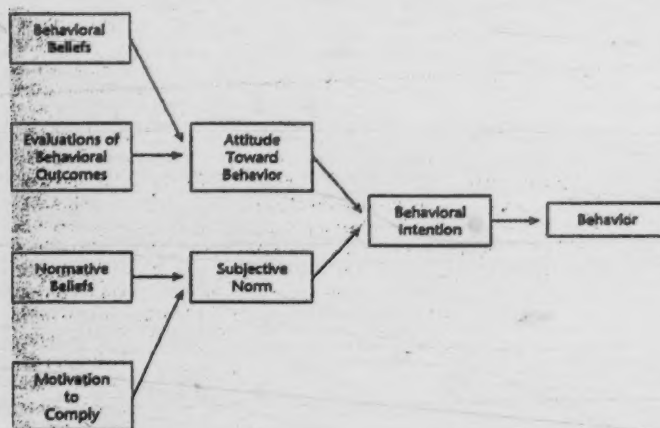


Figure 2. Theory of reasoned action (Ajzen & Fishbein in Glanz, Lewis, & Rimer, 1997).

TRA is most useful in formulating interventions that have an educational component, as its focus is determining the specific knowledge a person requires to change behaviour for a successful intervention. Another strength of TRA is in examining the underlying factors that determine beliefs about a behaviour whether or not they are based on rationale (Montana et al. in Glanz et al., 1997). TRA begins to include the social context through the subjective norm construct, but the reference point of the theory remains focused on the individual's perception.

Critics of the theory state that TRA is best used for behaviours under volitional control, thus limiting the applicability of TRA. There is concern that under adverse conditions, intention towards behaviour may not translate into actual behaviour. In addition, HBM and TRA are both criticized for striving towards a single prediction rule when recent research has uncovered the complexity of behaviour (Weinstein, 1993).

Prototype- Willingness theory. A limitation of the HBM and TRA on risk behaviour is the assumption that the individual follows a rational process in making health behaviour decisions (Gibbons, Gerrard, Blanton & Russell, 1998). Gibbons and Gerrard (1995) challenge this assumption by questioning the rationale behind choosing to drive drunk or choosing to acquire a STI. The prototype-willingness model is an alternative to understanding adolescent risk behaviours and has been used in studying smoking, unwed teenage pregnancy, and sexual activity (Gibbons & Gerrard, 1995). This model begins to include elements of the adolescent's social context but again focuses on the thought processes of the individual.

Gibbons and Gerrard (1995) explain a young person's decision to engage in "adult-like" behaviour as an attempt to acquire the image that they associate with the behaviour. A prototype is constructed around an image and becomes a goal state for the adolescent. The closer the adolescent associates to the prototype, the greater their intent is in joining the group and the behaviour. The model assumes adolescent behaviours are reactions to risk-inducive situations that occur as social events (Gibbons et al., 1998). Greater behavioural willingness (BW) towards a behaviour is dependent on four environmental factors. The first three factors are similar to constructs in TRA and HBM: perceptions of important others engaging in the behaviour, adolescents' positive attitudes toward the behaviour, and adolescents' past engagement in behaviour. The fourth factor introduces the construct of the social image or prototype associated with behaviour. Those adolescents who engage most in social comparison will be the most affected by risk behaviour images and, therefore, are most at risk for adopting the health risk behaviour. A strength of the model is the concept of images influencing adolescent

behaviour, but with that strength comes a limitation, as the model does not explain how prototypes are formed or recognized by adolescents or explain the context that creates willingness for adolescents (Gibbons & Gerrard, 1995).

Prospect theory. Building on the limitations of the above theories, prospect theory attempts to capture the cognitive judgments involved in adolescent behaviour under environmental conditions of risk. McDermott (1998) describes the decision-making process as involving two phases. The first phase is framing or providing the context for decision-making. The context includes both distal factors, such as education, employment, ethnicity, and socio-economic factors combined with proximal factors such as alcohol, drugs and relationship issues. The second phase is evaluation, which is the subjective assessment of the situation. This assessment incorporates two aspects: value in terms of gains and losses, and weight, which is the probability of an event.

Two examples of the theory demonstrate the importance of the adolescent's life events in framing and weighing behaviour. A young woman with no future prospects of education or family may choose to have a baby to have someone to love, but the same young woman accepted to college with a future job secured might avoid an unexpected pregnancy. A strength of this model is the inclusion of the adolescent's social environment in terms of both population health determinants and situational factors. A similar limitation to other individual decision-making theories is its focus on the individual's decision-making processes.

Socio-environmental Context

Psychosocial Framework. An understanding of the complexity of variables in adolescent risk behaviour has become evident as different variables and limitations of the

above theories have been outlined. The complexity of this issue should be of no surprise as population health models have been outlining the many determinants of health that go beyond individual behaviour since Lalonde's report in 1974. He suggested that improvements to Canadians' health would be better achieved through investment in changes to lifestyle, social and physical environments and biology, than through increased funding to health services. Commonly agreed upon determinants of health include income, social support networks, education and employment, social environments, physical environments, biology and genetic endowment, personal health practices, healthy child development and health services. These determinants of health distinguish between individual risk behaviour such as condom use and risk conditions such as unemployment and substandard housing (Health Canada, 1996).

Jessor's psychosocial framework for understanding adolescent risk behaviour draws on the determinants of health. Jessor's (1992) psychosocial framework organizes risk and protective factors of adolescent behaviour across five domains that include biology/genetics, social environment, perceived environment, personality, and behaviour (see figure 3). All domains are interrelated, highlighting the multi-system complexity of the framework.

Whitbeck, Yoder, Hoyt and Conger (1999) reported that "the most robust and researched predictor of early adolescent intercourse has been adolescent participation in other adult-like or deviant behaviours" (p.935). Associations have been so strong between adolescent risk behaviours that researchers have suggested an underlying problem behaviour syndrome (Whitbeck et al, 1999; Brook & Brook, 1990; Jessor, 1992), where adolescents learn and engage in risk behaviours through social opportunities (Melzer-

Lange, 1998). Jessor's (1992) theory of problem behaviour provides an explanation within a developmental perspective where adoption of problem behavior meets specific developmental needs not being met by other sources. For example, the positive function of social acceptance by peers for smoking marijuana and the rejection of societal norms outweighs the negative health consequences (Spingarn & DuRant, 1996).

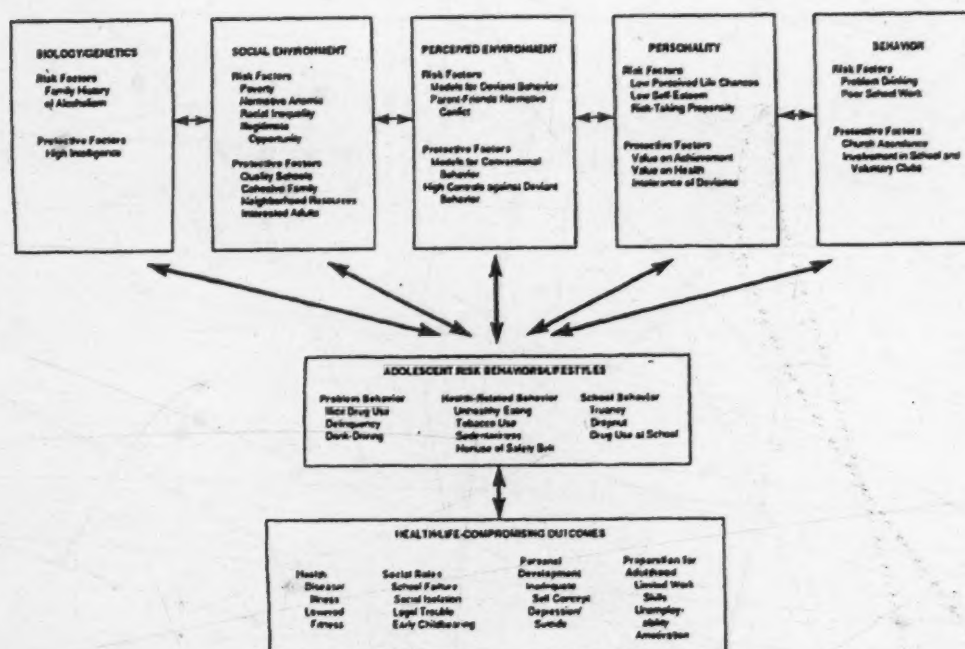


Figure 3. Interrelated conceptual domains of risk factors and protective factors (Jessor, 1992).

When reviewing the literature on adolescent risk behaviour many "survey style" studies were found with no theoretical development, but with findings of risk and protective factors to support Jessor's work. These findings will be included in the description below.

Biology/Genetic factors. Gender has been significantly related to risk behaviour.

For example, male adolescents have been found to be heavier drinkers than female adolescents (Allison, Adlaf, Ialomiteanu & Rehm, 1999), and have an earlier onset of both sexual behaviour (Thomas et al., 2000; Upchurch, Aneshensel, Sucoff & Levy-Storms, 1999) and sexual intercourse (Dolcini & Adler, 1994; Benda & Corwyn, 1999). One suggested explanation for the increased risk of male adolescents in terms of sexual behaviour has been that cultural scripts condone sexual activity for boys but not for girls (Benda & Corwyn, 1998). Another explanation for both male and female adolescent increased sexual interest has been the positive relationship to pubertal development and increased hormonal levels (Whitbeck et al., 1999). Adolescents of older age and male gender have been associated with sexual onset (Goodson, Evans & Edmundson, 1997), drug use, risky sex, and delinquent behaviour (Ludwig & Pittman, 1999).

Social Environment. Social systems and structures shape the experiences of adolescents (Upchurch et al., 1999). Upchurch et al. (1999) propose that neighbourhood opportunities and norms shape adolescent attitudes and behaviours. Neighbourhood socio-economic status is an index of availability and quality of services and resources to youth, as well as regulating exposure to hazards like crime and violence. It is hypothesized that adolescents from neighbourhoods with hazards have less social relations and fewer social controls to regulate adolescent behaviour. Upchurch et al.'s study of 870 adolescents supported this theory finding a younger age of sexual debut among adolescents from single parent or reconstituted families combined with an influence from neighbourhoods, as well as socioeconomic status.

One of the adolescent's most proximal social contexts is the family. The literature provides overwhelming evidence of the role of family, especially parent-child attachment in the successful development of adolescents (Brook & Brook, 1990, Turner, Irwin, Tschann & Millstein, 1993). Bonding theory supports Jessor's protective factor of having a cohesive family through its emphasis on a child's early attachment to his or her parents. This attachment to parents facilitates the adolescent's adoption of the parent's beliefs, superstitions, church attendance and commitment to achievement. This bonding to parents also inhibits unconventional behaviour and is the child's initial bonding to society, religion, common order and beliefs (Chen & Kaplan, 1997). Strong parent-child attachment is even more important during midadolescence when youth are formulating their identity by trying new roles (Benda & Corwyn, 1999). Protective factors of a cohesive family, such as attachment to the mother, parental supervision and support, and church attendance, have been negatively associated to risk behaviours (Benda & Corwyn, 1999; Goodson et al., 1997; Fahs et al., 1999).

Control theory suggests this bonding restrains adolescents from their natural instincts towards self-gratification and problem behaviour (Benda & Corwyn, 1999). An adolescent with poor attachment to parents lacks the identification with parental and societal values and the internal controls for behaviour (Health Canada, 1995). As well, poor attachment may leave adolescents seeking closeness with peers through sexual activity and the desire to have a baby (Benda & Corwyn, 1999). Parental support for the development of autonomy has been negatively associated with initiation of sexual intercourse (Whitbeck et al., 1999), while emotional detachment of adolescents from

parents positively relates to fighting, alcohol use, cigarette smoking, and marijuana use (Turner et al., 1993).

Another risk to the successful attachment of parent and child is maltreatment. Maltreatment in childhood has been associated with delinquency and risk behaviours in adolescence. Health Canada's (1995) report found that adolescents exposed to more than one form of maltreatment had a positive association with risk behaviour. Risk behaviours include running away from home, criminal charges, suicidal thoughts, and use of cigarettes, alcohol and drugs. Youth participated in one risk behaviour also reported likelihood in participating in other risk behaviours.

Perceived environment factors. Family plays another important role in modeling and monitoring health behaviours of adolescents through the health behaviours of parents and older siblings (Goodson et al., 1997). Adults are largely responsible for setting limits and monitoring environments for adolescents. Absence of parental supervision increases the chance of influence from peers (Chen & Kaplan, 1997). Increases in single-parent families and parents working full-time require youth to increase their responsibility for health behaviours like physical exercise, nutrition, and use of leisure time (Maddux et al., 1986). Maddux et al. (1986) argue that due to modeling and imitation of health behaviour, changes in adolescent health behaviour will not occur without a change in adults.

Studies have found adolescents in single-parent families are more likely to be sexually active (Thomas et al., 2000; Goodson et al., 1997; Upchurch et al., 1999). One account of these results is that because single parents have less time for social monitoring, coupled with the fact single parents may be sexually active, adolescents

model their behaviour after their parent and believe parents are permissive towards sexual behaviour (Thomas et al., 2000). Strain or opportunity theory suggests that lack of family support, resources and attachment causes adolescents to look towards sexual behaviour as a relief sought from feelings of inner frustration (Benda & Corwyn, 1999). Benda & Corwyn (1999) suggest that single-parent families who are more likely to face the stresses and deprivation of poverty have less of the emotional and social resources to provide the nurturance and supervision for their children. They argue, therefore, that family support is an essential variable in optimal child development.

Thomas et al.'s (1999) longitudinal study of 561 adolescents (15-18 years of age) found that parental monitoring deterred alcohol use but did not significantly reduce sexual risk-taking behaviour. They explain this finding in relation to cultural norms around alcohol use and sexual behaviour. An adolescent's first experience with alcohol may be in a controlled environment with adults, whereas most adolescents' information about sexual behaviour is obtained from peers. This finding leads us to another important influence on an adolescent's health behaviour: observational learning from peers (Goodson et al., 1997).

Pavis, Cunningham-Burley & Amos' (1998) study found the single most cited reason for adolescents drinking and smoking was the social activity with friends. Dolcini & Adler's (1994) work on crowd membership in adolescents identified multiple peer social groups rather than one adolescent culture. The authors speculate that crowds may mediate their effect on adolescent risk behaviour by providing opportunity and peer pressure. For example, socially competent youth, more attuned to adult-like behaviour, may find themselves with more opportunities to engage in risk behaviours through their

attractiveness to others (Ludwig & Pittman, 1999). Crowd membership also predicts alcohol use, cigarette smoking, and sexual intercourse (Dolcini & Adler's, 1994; Whitbeck et al., 1999).

Personality factors. Ludwig & Pittman's (1999) study of 2146 adolescents (12 to 19 years of age) examined the relationship between prosocial values, sense of belonging, security, sense of accomplishment, and self-efficacy (the belief in one's abilities to produce a desired outcome) in relation to delinquency, risky sexual behaviour and drug use. They found that adolescents with more prosocial values, greater self-mastery and feelings of trustworthiness exhibited lower levels of the three problem behaviours with the most variance being predicted for delinquency. Intervention specific findings suggest that programs for girls target the support of prosocial values, as this factor was negatively associated with problem behaviours, and programs for boys target increased efficacy expectation. The authors also caution that adolescents testing their values with high self-mastery are more vulnerable to risk behaviours (Goodson et al., 1997).

Chen & Kaplan (1997) warn of the subjective distress of family breakdown on adolescents experienced as psychological symptoms and self-rejection. This stress may be attributed to children being labeled and not fitting into the conventional family structure, and positive appraisals found in delinquent peers may remedy the resultant low self-esteem. As well Whitbeck et al. (1999) found support for low quality relationships with parents caused depressed emotional states and an increase in adolescents' vulnerability to peer influence.

Behavioural factors. Jessor's (1992) framework outlines adolescent behaviours that are associated with risk and protective factors. Many studies have supported his

thoughts on the protective nature of church attendance, positive attitudes towards school, expectations of further education or careers (Goodson et al., 1997; Allison et al., 1999), as well as time spent in school related activities and homework (Whitbeck et al., 1999). Allison et al. (1999) reported chronic stress to be one of the most consistent predictors of risk behaviours. Other research reports that use of alcohol at an early age is positively associated with increases in alcohol misuse and sexual risk-taking behaviour (Thomas et al., 2000; Whitbeck et al., 1999). The use of alcohol with sexual intercourse has significant consequences such as unprotected sex, pregnancy, STI, and sexual assault (Thomas et al., 2000). Melzer-Lange's (1998) review of adolescent risk behaviours has identified interrelationships between alcohol and drug use, sexual intercourse and resulting STI and pregnancies with violent behaviour.

Work by Gerrard, Gibbons, Benthin & Hessling (1996) addresses the reciprocal nature of risk behaviours and health cognition in adolescents. The question remains unanswered that if adolescents know the risks of health behaviours, why do they continue to pursue these behaviours? The authors found cognition shifts in adolescents participating in risk behaviours, whereby adolescents normalized the risk behaviour by increasing their perceptions of peer activity in the risk behaviour and by decreasing the perception of negative consequences.

One of the strengths of Jessor's framework is its comprehensiveness in determining both risk and protective factors in the development of problem behaviour and then the resulting health/life compromising outcomes, like STI and BBP. Social and cultural factors provide the meaning and choices to an adolescent while simultaneously constraining their perceptions and the options open to them (Pavis et al., 1998). The

multi-system complexity demonstrates the diversity that makes each adolescent who they are and makes the task of healthy adolescent development appear sometimes overwhelming.

Summary

From the epidemiological picture of Canadian STI & HIV infections presented, it is evident that STI prevention and control is very complex. With increasing rates of STI and HIV among Canada's subpopulations, it is pertinent for researchers to examine the behaviours practiced by this population in their role of transmission. Based on Jessor's framework of problem behaviour and other theories of adolescent risk behaviour, it appears street youth are at risk for the development of problem behaviour. Chapter 2 will review the literature for behaviours of street youth placing them at risk for STI acquisition and transmission.

Chapter 2

STI and Street Youth: Literature Review

The first Canadian study on street youth, *Street Youth & AIDS*, was published in 1990 (Radford, King, & Warren, 1990). This was the first national study to examine the demographics and behaviours of 712 street youth from ten urban centres across Canada. This chapter reviews studies on street youth and their behaviours related to STI acquisition published in the last ten years, building on our understanding of the issues identified in *Street Youth & AIDS*.

Method

A literature search was conducted across PsychINFO (1887-August 2002), CINAHL (1982-July 2002), Ovid HealthSTAR (1975-July 2002), and MEDLINE databases (1966-July 2002). An initial search was conducted to obtain homeless or street youth articles. A second search was conducted to obtain articles on sexual behaviour. A final search was conducted to obtain articles on sexually transmitted diseases. All subheadings were chosen for each of the three separate searches (see Appendix 1 for summary of search terms). Two combination searches were completed using the Boolean operator AND. The first combination search included homeless or street youth with sexual behaviour and the second combination search included homeless or street youth with sexually transmitted diseases. The search results were limited to human studies in English between 1993 and 2002. Finally, the search results from each of the four databases were reviewed for duplicates resulting in 74 studies available at the University of Alberta library services.

For final inclusion into the review, abstracts of the 74 studies were reviewed against the following exclusion criteria: (1) non-empirical studies, (2) program evaluations, (3) qualitative studies, (4) non-street youth population, and (5) no inclusion of sexual behaviour measures. Five additional studies that met inclusion and exclusion criteria were added by a manual search. The resulting 42 studies were then coded according to (1) country of origin, (2) study design, (3) definitions of street youth, (4) recruitment strategies, and (5) behaviours (i.e. substance use, sexual behaviour, STI/HIV testing, education and employment).

Results

The Study of Street Youth

Street youth in North America (Canada and the United States) have been the most studied populations with involvement in 36 studies; American street youth being the most studied population with involvement in 25 of those 36 studies. Of the 11 Canadian studies, MacDonald, Fisher, Wells, Doherty, and Bowie (1994) provide the only national study with street youth being recruited from ten urban cities, including Edmonton. The majority (8/11) of the Canadian studies took place in central Canada (Ontario and Quebec), with the remaining two studies completed in Edmonton and Vancouver. Unfortunately, these regional findings can not be generalized to form a national perspective, as Canada's regions are very diverse in culture and ethnicity.

Definitions of Street Youth

A crucial consideration in comparing studies of street youth is determining the definition of the study population. Inclusion criteria across the majority of the (39/42) studies incorporated two criteria: age and street life related behaviour. The largest age

range of 13-29 years was in Sullivan et al.'s (1996) American study. With this exception, the remaining 38 studies limited age ranges to 25 years and younger, which is helpful when comparing national STI rates as youth aged 15-24 years represent the age ranges with the greatest concern of STI prevalence (Health Canada, 2000b).

The second inclusion criterion for most (33/42) of the studies was STI-related behaviour, which was defined through various activities or circumstances. Wittig, Wright & Kaminsky (1997) adopted a broad understanding of street life and utilized the United Nations' definition of a street child for their inclusion criteria:

Any girl or boy...for whom the street (in the widest sense of the word, included occupied dwellings, wasteland, etc.) has become his or her abode and/or source of livelihood; and who is inadequately protected, supervised, or directed by responsible adults (ICCB cited in Wittig, Wright & Kaminsky, 1997, p. 810).

Similar elements of this definition are found in other studies' inclusion criteria, for example (a) spending the previous night outside or in a shelter (Clatts, Davis, Sotheran, & Atillasoy, 1994), (b) spending less than 30 days with a guardian in last six months (Noell et al., 2001a, b, & c; Rohde, Noell, Ochs, & Seeley, 2001), or (c) being involved in the street economy (such as panhandling, prostitution, or drug sale; Clatts et al., 1998; Clatts & Davis, 1999). Other studies' inclusion criteria included the utilization of a street youth serving agency, spending a specified amount of time on the street, or being out of school. By utilizing these inclusion criteria, the researchers hoped to limit the number of "weekend warriors" and after school "curb kids" and focus samples on serious at-risk youth spending the majority of their time on the streets (Baron, 1999).

Another approach to defining study populations was to include all those who utilize a particular service. By not using any other inclusion or exclusion criteria, researchers were able to capture a very wide and diverse representation of all the service users. Eight of the reviewed studies utilized this method and targeted venues where street youth congregated, for example drop-in centres, shelters, or health related venues.

Recruitment Methods

The transient nature of street youth, often considered a hard to reach population, posed challenges to recruitment strategies and research designs. Many times street youth are out of school, are without telephone or fixed address, and therefore are likely to be missed in traditional methods of gathering population data, for example national or regional surveys (Faugier & Sargeant, 1997). Adding to the difficulty in recruiting youth is the need to collect information on potentially illegal activity, like drug use, or disclosures that may require notification of child protection authorities. Posing a greater challenge is recruiting youth for a prospective study, hence the limited use of a longitudinal design amongst the reviewed studies.

Another challenge street youths' transient lifestyle posed to recruitment is ensuring representative samples. Probability samples are difficult to determine for a number of reasons. First, very few studies have attempted to estimate the population of street youth in a given centre. Second, the group composition and size is always changing, and finally, it is difficult to determine "the probability of selecting a given youth" (Smart & Adlaf, 1991, p. 1001) due to the many programs used by street youth.

For the reasons cited above, the majority (38/42) of studies utilized varying forms of nonprobability sampling: convenience sampling, purposive sampling, and snowball

sampling. The remaining four studies utilized different sampling methods to increase the representation in their samples. The first strategy used by MacDonald et al. (1994) is quota sampling, another form of nonprobability sampling. They identified subgroups of their study population and recruited youth for each category. The subgroups included prostitutes, drug abusers, youth offenders, homeless youth, and unemployed youth. To ensure regional representation across Canada, street youth were recruited from ten urban cities as well as including 61 native youth to ensure representation in ethnic diversity.

A second strategy used by Clements, Gleghorn, Garcia, Katz, and Marx (1997) also utilized some elements of quota sampling. Clements et al. adopted a systematic sampling approach where researchers' first goal was to identify primary sampling units (PSU), locations where street youth congregated. Researchers then observed the PSU to determine the average number of participants accessing each location. From this information, researchers calculated a predetermined sample size for each PSU to ensure proportionate representation. Interviewers then approached every second youth at the PSU for participation in the study.

A third strategy in sample selection utilized by Kipke, O'Connor, Palmer, and MacKenzie (1995) was a stratified probability sample, randomly selecting recruitment sites. Through observation of the community, recruitment sites were identified and classified as either "fixed" service sites (shelters and drop-in centres) or "natural" street sites (streets and hang-outs). Recruitment sites for inclusion into the study were then randomly chosen with 70% of the sample from natural sites and the remaining 30% from "fixed" sites.

The final strategy combined random recruitment with convenience sampling. Greene, Ennett, & Ringwalt (1999) recruited youth for their national shelter sample by choosing representative PSU in each city and then identifying shelters within that PSU. Youth were then randomly selected from the shelters after meeting eligibility requirements. Researchers in this study were also posed with the difficulty of recruiting youth from the street and elected to adopt a convenience sampling method for this hard-to-reach population utilizing multiple sites among the PSU.

Recruitment strategies common to all of the studies were utilization of community-based organizations to reach their target populations. All of the studies recruited youth from multiple sites to increase representation and reduce recruitment bias: 57% (24/42) of the studies utilized agencies designated for the service of street youth, 48% (20/42) of the studies recruited youth from shelters, 14% (6/42) of the studies recruited homeless youth utilizing health care services, and finally 12% (5/42) of the studies utilized other recruitment settings such as detention centres or bars. A potential selection bias may occur from recruitment solely from street youth serving agencies as representation of marginalized street youth not seeking the services of these agencies may be missed (Roy et al., 2000). Therefore 57% (24/42) of the studies recruited youth directly from the street.

Study Design

Many of the inclusion criteria outlined above require the youth to have no fixed address, thus precluding systematic follow-up of a street youth cohort over time. Thus, the majority (38/42) of the studies reviewed utilized cross-sectional research designs using face to face structured interviews with street youth to elicit risk behaviours based

on self-report. Despite the challenges imposed in undertaking a longitudinal study, Noell and his colleagues utilized this research design in their four studies with measures completed at baseline, 3 months and 6 months; follow-up data were available for 76.9% of the participants. Similar to the other studies reviewed, two of the Noell et al.'s studies utilized a cross-sectional design to report their findings from the baseline measure (Noell et al., 2001b; Rohde et al., 2001).

Behaviours Associated with Street Youth

Two considerations arose when reviewing the results of the studies. The first consideration was the time lag between data collection and publication dates. Current trends in drug use, sexual behaviour, and the current rise in rates of STI may not be reflected by older data, with the majority (30/34) of studies collecting data in 1995 or before making the data a minimum of seven years old in relation to present trends. The last Edmonton data were collected in 1988. The most recent data is found in Haley et al.'s (2002) study with interviews completed in March 2000, only three months into the rise in chlamydia and gonorrhea rates found nationally for 2000 (Health Canada, 2000b).

Another consideration in reviewing the results is that eleven of the studies have shared data sets with other studies, thus reducing the overall number of street youth interviewed. See Table 2-1 for a list of shared data sets.

Many of the studies point to the multiplicity of health concerns for street youth. The most common risk behaviours reported in 90.5% (38/42) of studies were substance use and sexual activity. The next most frequent risk behaviour measured in 64.3% (27/42) of studies was street youth's participation in survival sex; sex traded for shelter, food, money, or drugs. Eight other studies reported on delinquent behaviours. The most

common protective behaviour measured in twelve of the studies was school attendance. Ten of the studies measured previous STI/HIV testing and six of the studies asked about employment.

Table 2-1

Shared Data Sets

Shared Data Sets

Clatts et al. (1998) & Clatts & Davis (1999)

Noell et al. (2001a,b,c) & Rohde et al. (2001)

Roy et al. (1999, 2001, & 2002)

Campos et al. (1994) & Raffaelli et al. (1993)

Risk behaviours associated with STI

Selection of STI Prevalence Studies. To further explore the reported behaviours and their associations with STI acquisition, a subset of 18 studies was selected for more detailed review. These studies were selected for their measurement of STI prevalence at the time of data collection. Confirmed STI cases versus self-report of STI history provides a stronger research design for determining behaviour associations. Clients' self-reports of STI history are subject to bias, such as under-reporting STI history due to the stigma attached to acquiring a STI or over-reporting STI history due to a client's assumption of their positive status when named as a contact to a STI. Therefore, a subsample of studies measuring STI prevalence was coded according to (1) design type, (2) sample size, (3) STI prevalence, and (4) behavioural correlations.

Results. Table 2-2 presents study characteristics for the subsample of 18 prevalence studies. General characteristics included sample sizes ranging from 100 to 79,802 street youth ($M = 4821$, median = 437, $SD = 18,714$). The majority (16/18) of studies utilized a cross-sectional design. The remaining two studies utilized a longitudinal design as previously described. Rouget, Mah, Lang, and Joffres' (1994) was the only study to utilize a non-equivalent control group of adolescents from an adolescent medical clinic. The prevalence of STI was measured through the collection of biological markers in eighteen studies.

Table 2-2

Study characteristics and results of 18 STI prevalence studies.

Author	Study Design	# sample size	STI prevalence	Significant Behavioral Predictors
Alderman et al. (1998)	Cross-sectional	148	HBsAg 0.7% (1/148) AntiHBc 6.8% (10/148) AntiHBs 8.8% (13/148)	Homelessness (14.5OR) Lifetime history of: Survival sex Sexual abuse Chlamydia Anal sex
Beech, Myers, & Beech (2002)	Cross-sectional	150	Hepatitis B or C 22% (27/150)	Homosexual or bisexual (3.2OR) Age (1.5OR) for each year increase
Dematteo et al. (1999)	Cross-sectional	695	HIV 2.2% (15/695)	Being 20 years or older Lifetime history of: MSM Survival sex IDU
Haley et al. (2002)	Cross-sectional	302	Chlamydia 6.6% (20/302) Gonorrhea 0% (0/302)	Lifetime history of pregnancy (2.9x)
Moon et al. (2000)	Cross-sectional	334	HIV 3.9% (13/334)	Gay/bisexual male
Noell et al. (2001a)	Longitudinal	216	HSV-II 8.2% (18/216) HBV 2.5% (5/216) Chlamydia 5.5% (12/216)	Greater than one partner in last 6 months ($r = 0.29$)
Noell et al. (2001b)	Longitudinal	536	Chlamydia 4.9% (29/597)	Sometimes or never using condoms (4.8OR)

Author	Study Design	# sample size	STI prevalence	Significant Behavioural Predictors
			HSV-II 7.2% (42/584) HBV 2.7% (16/584) HCV 3.9% (23/584) HIV 0.3% (2/584)	# of partners for females in last 3 months (3.5OR) Lifetime history of IDU for HCV (22.4OR) and HBV (10.6OR)
Ochnio et al. (2001)	Cross-sectional	494	Anti-HAV 27.9% (134/494)	Increased age Birth in a country with a high prevalence of HAV IDU among 25-34 years old Heterosexual IDU (3.9OR)
Porto et al. (1994)	Cross-sectional	496	HBsAg 2% (10/496) AntiHBc 13.5% (67/496) AntiHBs 5.4% (27/496) AntiHBcIgM 0% (0/496)	For AntiHBc: Lack of family links (4.1OR) Lifetime history of sexual activity (2.1OR)
Poulin et al. (2001)	Cross-sectional	626	Chlamydia 5.8% (36/626) Gonorrhea 1.2% (7/626)	Less than 20 years of age (2.6OR) In last six months: IDU (2.8OR) Occasional sex Partner (2.9OR)
Rohde et al. (2001)	Cross-sectional	523	HSV-II 8.2% (43/523) HBV 2.5% (13/523) Chlamydia 5.5% (29/523)	Hopelessness in older participants
Rouget et al. (1994)	Cross-sectional	137	Gonorrhea 14% (19/137) Chlamydia 24.1% (33/137)	No logistical regression provided.
Roy et al. (1999)	Cross-sectional	437	HBsAg 1.6% (7/437) AntiHBc 7.6% (33/437)	Greater than 18 years (4.5OR) Lifetime history of IDU (3.5OR) Sexual partner with unspecified hepatitis (3.2OR)
Roy et al. (2000)	Cross-sectional	909	HIV 1.87% (17/909)	Older than 20 years of age (7.09OR) Born outside of Canada (4.41OR) Lifetime history of: IDU (4.48OR) & Prostitution (3.32OR)
Roy et al. (2001)	Cross-sectional	437	HCV 12.6% (55/437)	Lifetime IDU (28.4OR) Greater than 18 years of age (3.3OR) Lifetime crack cocaine use (2.3OR)
Roy et al. (2002)	Cross-sectional	427	AntiHAV 4.7% (20/427)	Born in country with high prevalence of HAV (200.7OR) Sexual partner with unspecified hepatitis (13.8OR) Insertive anal sex (5.1OR)
Sweeney et al. (1995)	Cross-sectional	79802	HIV 0.7% (591/79802)	Females (2.6OR) to male in corrections subgroup
Tam et al. (1996)	Cross-sectional	100	Chlamydia 22% (22/100)	No logistical regressions provided.

C. trachomatis and *N. gonorrhea* prevalence. Seven of the studies collected biological markers measuring the prevalence of *C. trachomatis*, and three of the studies jointly measured the prevalence of *N. gonorrhea*. Prevalence rates of *C. trachomatis* ranged from a low of 4.9% in Noell et al.'s (2001b) study to a high of 24.1% in Rouget et al.'s (1994) study. Prevalence rates of *N. gonorrhea* range from no cases found by Haley et al. (2002) to a high of 14% in Rouget et al.'s study. Specimen collection for Rouget et al.'s study was collected in 1988, in a clinic setting. Researchers did not report testing methods or sensitivities, but data collection occurred pre-NAAT testing. An account for the higher rates found among Rouget et al.'s population is that the site of recruitment was medical clinics, providing a more symptomatic population than those youth recruited through community outreach settings.

Noell et al. (2001b) calculated an annualized incidence of *C. trachomatis* among their population of 7.43% for males and 12.10% for females. Incidence of *C. trachomatis* was calculated by counting a new case when a negative result was followed by a positive result in any of the three-month periods. The benefit of calculating an incidence rate is that it allows comparison with national incidence rates. One limitation the authors noted in determining their incidence measure is that by requiring a negative test during a three month period new infections may be missed. Youth could have a positive result at baseline, receive treatment and become re-infected at the three-month measure. Despite this limitation, the incidence rates found by Noell et al. (2001) far exceed the Health Canada (2002) goal of <50/100,00 cases, as well as the national rate of 161.0/100,000; thus supporting the idea of core groups serving as reservoirs of STI infection.

Viral hepatitis prevalence. Ten studies examined the prevalence of viral hepatitis among street youth. The first hepatitis prevalence reported is HAV, a vaccine preventable infection. Past infection with HAV was measured by Ochnio, Patrick, Ho, Talling, and Dobson's (2001) study using a mouth swab. This testing method reported a 99% sensitivity and specificity when compared to serology, providing a less invasive testing alternative. The overall prevalence rate was 27.9% (138/494), with a prevalence rate of 6.3% in the street youth subgroup. Roy et al. (2002), utilizing sera from a previous study, found a similar rate of 4.7%.

The status of HBV prevalence was measured using four different serological markers. The first marker was Hepatitis B surface antigen (HBsAg) indicating active infection. The second marker was antibody to hepatitis B core antigen (antiHBc) measuring previous infection. The third marker was an AntiHBc IgM and when elevated indicates an acute infection process. The final marker was antibody to HBsAg (AntiHBs), indicating immunity (Health Canada, 1998).

Prevalence rates for active or infectious HBV ranged from 0.7% found in Alderman et al. (1998) to 3.6% in Noell et al. (2001b). Rates of past infection with HBV ranged from 6.8% in Alderman, Shapiro, Spigland, Coupey, Bashir, and Fox's (1998) American population to 13.5% in Porto et al.'s (1994) Brazilian population. Rates of immunity from HBV included a low 5.4% in Porto et al.'s study to a high of 8.8% in Alderman et al.'s study.

Further studies in Canada are required to measure the prevalence of HBsAg and AntiHBs to evaluate the reach of provincial and territorial universal immunization programs recently initiated. Studies suggest that street youth leave school during

secondary grades (Radford, King, & Warren, 1990; Smart & Ogborne, 1994), therefore many of the youth on the streets may have been immunized for HBV in preschool or primary school programs and therefore have immunity. As well, the advent of outreach health services providing immunization to street youth may reflect a higher rate of immunity.

Only three studies measured HCV prevalence despite the occurrence of IDU among street youth. Prevalence rates ranged from 5.0% in Noell et al.'s (2001b) study and 12.6% in Roy et al.'s (2001) study. Future studies of HCV prevalence will be pertinent to researchers, as there is no cure for HCV and, once infected, there is a potential for spreading the virus throughout their lifespan. As well, HCV is a chronic illness and will have health care implications as street youth populations age.

HIV prevalence. Five studies measured HIV prevalence. Four of the studies used serological testing while Roy et al. (2000) utilized saliva based testing. Sensitivity and specificity were not reported. HIV prevalence ranged from 0.3% in Noell et al.'s (2001b) study to 3.9% in Moon et al.'s (1999) study of San Francisco street youth. One reason that HIV prevalence may be lower than other STI is that HIV incidence tends to be distributed in older age ranges as compared to the younger age ranges studied in the reviewed articles (Health Canada, 2000a).

Herpes prevalence. Noell and his colleagues studied the prevalence of HSV among their population of street youth. Prevalence ranged from 7.2% to 8.2% depending on the subsample analyzed from their larger study population. This virus is similar to HCV, where the possibility of spreading the infection lasts throughout most of one's life span but unlike HCV, may be more easily transmitted as it does not require invasive

behaviour like IDU, but only requires skin-to-skin transmission when the virus is shedding. As well, outbreaks of HSV have been linked to the acquisition of other STI and HIV (Holmes et al., 1999). One limitation of these studies is that HSV-II prevalence detected through sera does not tell us the location of the infection, genital or oral. Although HSV-II is most commonly found on the genitals, it can also be isolated from non-genital sites. Similarly HSV-I has increasingly been isolated from genital sites, commonly transmitted through practices of oral sex. This means that crucial information on the disease burden of HSV-I remains unknown.

Risk Factors and Significant Behaviours. Several risk factors and behaviours were found to be significant across the prevalence studies. Older age was significant in six of the studies and was significant in all of the blood-borne pathogens (BBP), HBV, HCV, and HIV. Younger age was found to be significant in Poulin et al.'s study of *C. trachomatis* and *N. gonorrhea* prevalence which correlates with Health Canada's higher rates among the younger age groups (Health Canada, 2000b). Injection drug use was significant in seven of the studies and across all the BBP, which is expected as IDU facilitates transmission of these viruses.

Sexual behaviours were significant in eleven of the studies. Behaviours ranged from number and type of partners, to involvement in survival sex, and sexual practices.

Research Questions

Health Canada's (1998) identification of street youth as a core group in the perpetuation of STI highlights the need for further research on the behaviours of Canadian street youth. The *Street Youth & AIDS* study (Radford et al., 1990) provided us with our first national data set on street youth and their sexual behaviours. Since that

time, a limited number of studies have been completed regionally in Canada to determine the prevalence of STI among street youth. These studies have been limited in sample size and to certain regions of Canada, limiting their generalizability to other Canadian cities.

Based on this review of the literature, which revealed limited description of Edmonton street youth, an evaluation of this population is timely. Street youth have been considered a hard-to-reach population, but with the advent of NAAT testing, reliable outreach testing can be taken to areas where street youth congregate. Using newer testing methods, the literature revealed significant STI prevalence among street youth, serving as a reservoir of infection, as well as participation in behaviours associated with STI and BBP transmission.

In order to prevent and control STI in Edmonton, we need to learn more about our street youth population as a core group. Therefore, the overall purpose of this study is to investigate the social determinants of health among Edmonton street youth that are associated with health enhancing behaviours related to the prevention of STI acquisition. The specific objectives of the study are:

1. To identify differences between a subset of youth who have been immunized against HBV versus those who have not;
2. To identify characteristics of this population which lead to STI/BBP testing;
3. To determine the prevalence of chlamydia, gonorrhea, syphilis, HIV, HBV, HCV, HTLV-I/II and HSV-II among Edmonton street youth;
4. To identify differences between a subset of street youth who have acquired STI/BBP versus those who have not.

Hypotheses for this study were:

1. Younger age, school attendance, and living with parents will be associated with immunization for HBV due to recent initiation of school-based immunization programs.
2. Older age, history of STI/BBP, and increased # of partners will predict STI/BBP testing.
3. STI rates will be higher among Edmonton street youth than the national average for youth 15-24 years of age.
4. Risky sexual behaviour and substance use will be associated with STI/BBP acquisition and transmission.

Chapter 3

National Study Methods

In 1998, Health Canada began the Enhanced STD Surveillance of Canadian Street Youth and launched a national, multi-centre, cross-sectional surveillance system. During the initial year, a pilot project was undertaken in three cities to determine the feasibility of this project. The success of the pilot project led to Phase II data collection in 1999 and Phase III data collection in 2001. Phase IV data collection began in March 2003 with subsequent data collection contingent on budget approval. The goal of the surveillance project was to:

Provide information on the sexual health and sexual behaviours of Canadian street youth which is essential for developing appropriate and effective disease prevention programs. (Health Canada, 2000d, p.4).

Snowball sampling was used for recruitment; participants were asked to inform other youth within their social networks that the study was being conducted. Participants were recruited from a minimum of three "drop-in centres" within each of the following major cities in Canada; Vancouver, Edmonton, Winnipeg, Toronto, Saskatoon, Ottawa and Halifax. Potential study participants were screened against the selection criteria outlined in Table 3-1. Youth were asked to complete a questionnaire with the interviewer and were asked to participate in the laboratory component of the study, which included collection of urine and blood specimens. Urine testing was done to detect *C. trachomatis* and *N. gonorrhea*; blood was collected to test for various BBP (HIV, HCV, HBV, and HTLV-I/II) and STI (HSV-I/II with syphilis added for Phase III). Youth had the option of declining any question and the option to decline all or some of the lab portion of the

study. Clients received \$10 in fast food vouchers for their participation in the questionnaire portion of the study. Researchers were available to answer any STI related questions and to provide referrals for any other concerns raised during the interview. The national protocol was followed in Edmonton and will be detailed more thoroughly later in this chapter.

Table 3-1

Inclusion Criteria for Participants

Participants were:	In addition, they also:
• 15-24 years of age AND • able to understand spoken French or English AND • able to understand and recognize the purpose of the study	• frequented an organization dedicated to street-involved people at time of recruitment. Or in the last six months, • used the services of one of the above agencies. Or • had run away from home or other place of residence for three days or more or • been thrown out of home for three days or more or • were without a fixed address for three days or more.

Note. Youth who met the age criteria but who had not been out of home or other place of residence for three days or more, were not included in the study.

Edmonton Study Methods

Participants

A total of 699 street youth participated in Phase II (299 youth) and Phase III (400 youth). Recruitment of a convenience sample was obtained through weekly visits by interviewers to community agencies providing service to street youth. The five agencies included three drop-in centres and two shelters. Refusal rates were not calculated but researchers from the Edmonton site had little difficulties recruiting youth for the study.

Research nurses experienced in working with street-involved youth approached youth at recruitment sites to participate in the study. The research nurse explained to participants the purpose of the study in simple, clear language. Informed consent was received from interested participants after the interviewer provided a verbal explanation of the study as outlined in the information letter and consent checklist (see Appendix 2). The questionnaire and lab portion of the study took place in private rooms in the drop-in centres.

Procedure and Materials

Questionnaires. Two questionnaires were administered to youth agreeing to participate in the enhanced surveillance project. The first 25-minute questionnaire preceded the collection of urine and blood specimens. The Phase II questionnaire consisted of 42 items and was modified from the pilot phase version. The pilot phase version was tested for validity of responses to similarly worded questions using kappa statistics. Additional questions, which were validated on similar populations, were added from research conducted by Roy et al. and the Vancouver Injection Drug Use Study (Health Canada, 2003a). The Phase III questionnaire consisted of 41 similar items in

order to allow for comparison between phases. Minor revisions were made in order to glean further insight into certain areas of interest developed from Phase II responses.

The questionnaires included a core set of questions on demographics, including age, gender, birth place, residence, income, and level of education. The questionnaires gathered information on social environment including reasons for leaving home, permanent housing, and contact with parents/caregivers. A section on substance use included a description of the youth's use of alcohol, cigarettes, non-injection drugs as well as injection drug use. A self-esteem scale was also included. Questions related to sexual behaviours included age at first intercourse, number of sexual partners, sexual preferences, type of sexual activity, condom use, history of STI, STI assessment, and partner notification.

The second 5-minute questionnaire was interviewer administered to all subjects with positive results who returned to the interview site for their laboratory results. The questions addressed further issues around partner notification and clients were provided with advice on treatment and follow-up care. Laboratory confirmed cases of *C. trachomatis* were treated with 1 gram of Azithromycin and cases of *N. gonorrhea* were treated with 500 mg of Ciprofloxacin according to the Alberta Health's (1998) *Treatment Guidelines for Sexually Transmitted Diseases*. Sexual contacts were identified and contact tracing was initiated by Capital Health's STD contact tracing nurses. Youth with reactive syphilis or positive AntiHBc results were advised of recommended medical follow-up for their results.

Laboratory testing. Youth who consented to the laboratory portion of the study were asked to provide a first void urine specimen (10-20 ml) for testing of *C. trachomatis*

and *N. gonorrhea*. Urine specimens were maintained at 4 degrees Celsius until transported to the Northern Alberta Provincial Laboratory. PCR testing was done using the Roche Amplicor kit according to manufacturer's directions. All positive lab results were dually reported to the research team and to Alberta Health.

Two vials of blood were requested from participants. The first vial of blood was tested for antiHBs and antiHBc to determine if youth had been immunized or previously exposed to HBV. Syphilis serology was added to the STI screening from the first vial of blood during Phase III due to the syphilis outbreak in one of the participating study sites. The results of these two tests were reported back to the youth when they returned for their results. Education around Hepatitis B immunization was given dependent on the results.

The second vial of blood was stored and tested for HIV, HCV, HTLV-I/II and HSV-I/II at a later date. Youth had the opportunity to decline testing for any one of these additional STI. This vial of blood would be unlinked from the participant and therefore the youth would not receive the results. Sera for storage was transported to the Northern Alberta Provincial Laboratory and frozen at minus 70 degrees Celsius until shipment to the National Reference Laboratory occurred. See Table 3-2 for specific testing methods.

Information linking the participant's name (this may have been a nickname the subject chose) and study identification number were kept in a log book by the nurse for the purpose of linking each participant returning to the interview site with their laboratory results. As treatment was given to all participants with laboratory confirmed positive results, the link between the laboratory results and individual was vital. The Health Research Ethics Board of Capital Health approved the study.

Table 3-2

Serological Testing Methods for HIV & HCV

Serological Testing Methods
HIV antibody screening: the Genetic Systems HIV ½ synthetic peptide EIA was used for the initial screening. Repeatedly reactive results were confirmed by the Cambridge Biotech HIV western blot.
HTLV antibody screening was done with the Ortho HTLV I/II Anitbody Capture EIA test for the initial screen. Repeatedly reactive results were confirmed by the INNO-LIA HTLV I/II test.
HSV testing: an algorithm incorporated a combination HSV I/II EIA (Meridian) was used for the intial screen. Repeatedly reactive results then underwent further screening using a type specific HSV-1 (Meridian) and HSV-2 (Meridian) specific EIA test. Repeatedly reactive and discordant results on type-specific EIA were confirmed by a type-specific line immunoassay (MRL Diagnostics).
Hepatitis C: the Ortho HCV 3.0 EIA was used for the initial screening. Repeatedly reactive results on the EIA were resolved by an immunoblot (HCV 3.0 RIBA) assay. In a low -prevalence population the RIBA (v3) assay has high sensitivity (negative RIBA results mean that the EIA was a false-positive) and high specificity (high positive predictive value, i.e. that is to say HCV RNA is detected in >~80% of RIBA v3 positive samples). Note that both the HCV (v3) and HCV RIBA (v3) assays are newer assays which have significantly improved the lower specificity and sensitivities associated with the earlier versions of HCV serological testing kits. In the rare event that an indeterminate result was obtained on the RIBA (v3) assay, PCR testing was then used to help resolve these samples by differentiating between acute vs chronic infection.

Source: Health Canada, 2000d, p.7

Statistical Analyses

Secondary analyses of Edmonton data collected as part of Health Canada's STD Enhanced Surveillance of Canadian Street Youth were performed. Data were analyzed using the Statistical Program for the Social Sciences (SPSS). To ensure that street youth did not participate more than once in data collection, each Phase of the data set was reviewed for duplicate birth dates with matching gender. These matches were then reviewed against the master logs for names when available, matching HBV serology, and other variables that were posed as open-ended questions, such as the city of birth,

ethnicity, and drug preference. As well, Phase III participants identifying that they had participated in the previous phase of the study were also removed from the total sample. In order to maximize the number of biological samples available, the earliest date of participation of the youth was used which included biological specimens.

Our analyses were limited to the variables collected by the Health Canada surveillance study. Both questionnaires were reviewed to develop a comprehensive list of matching variables for appropriate coding in the database. These variables are listed in Table 3-3.

Table 3-3

Variables grouped according to Jessor's Psychosocial Framework.

Biology	Social Environment	Perceived Environment	Personality	Behaviour
· Ethnicity · Birth date · Gender · Nationality	· Social worker ever · Foster or group home ever · Currently living with parents - Abuse: · unwanted sex ever · left home due to abuse	· Contact with either parent x 3 mos. · Either parent ever inject drugs	Self-esteem items: · regret · confidence · indecisive · appearance · cared for · interest · depressed · suicidal · happy	Delinquency: · ever been in prison · probation officer ever · ever absent from school Substance use: · daily tobacco use · alcohol use x 3 mos. · non-injection drug use ever · injection drug use ever Sexual Behaviour: · sexually active · age sexual menarche · # partners x 3 mos. · sexual activity (heterosexual or same sex) x 3 mos. · type of sexual activity (vaginal, oral, anal) x 3 mos. · ever exchanging sex · believe no risk for STI/BBP · prior STI · previously tested for an STI

Descriptive Analyses. A thorough examination of all single and multi-item variables was conducted. Frequency tables were used to describe the prevalence of STI/BBP. The total population was described according to the variables outlined in Table 3-3 using frequency tables and measures of central tendency.

Factor Analysis of Self-esteem Items. Development of the self-esteem items for the national study was based on items used in the *Canada Youth and AIDS Study: Technical Report* (King, Cole, & King, 1991). Five point Likert self-esteem and mental health scales were constructed from a large pool of items measuring aspects of adolescent's lives used in previous work by King et al. Using factor analysis, the scales were refined and posted Cronbach's α of .62 and .64 respectively, among the street youth subpopulations (see Table 3-4 for the scales). The *Enhanced STD Surveillance of Canadian Street Youth* study adapted these scales to form the eleven self-esteem items used in our questionnaire. In this study, factor-analytic techniques were also used to determine whether the eleven exploratory items on self-esteem reflected a single underlying dimension. These analyses eliminated redundant and/or nondiagnostic items and establish reliability of the resulting scale. The resulting scale was then entered into further analysis using logistic regression.

Table 3-4

Canada Youth & AIDS Study scales.

Self-esteem Scale	Mental Health
I often am sorry for the things I do.*	I am a happy person.*
I have confidence in myself.*	I often cannot sleep worrying about things.
I have trouble making decisions.*	I often feel lonely.
I would change how I look if I could.*	I often feel left out if things.
I often wish I were someone else.*	I often get frustrated.
I like myself.*	I often feel depressed.*
I often feel left out of things	I sometimes have thoughts about killing myself.*
	Life is just one worry after another.
	The future looks good to me
	No one cares much about what happens to me.*

Note. *items included in *Enhanced STD Surveillance of Canadian Street Youth*

Immunization Logistic Regression. The first model to be tested used logistic regression analysis to examine the determinants of immunization status ($n = 120$) for Hepatitis B. Immunization status was determined by a positive antiHBs result. (Youth who were positive for both antiHBs and antiHBc ($n = 6$) were removed from the immunization analyses). Variables from Table 3-3 were entered into the model.

STI/BBP Testing Logistic Regression. Similarly, the second model used logistic regression analysis to examine significant determinants related to street youth who agreed

to testing for STI/BBP ($n = 489$) in this study, using the same variables as outlined in Table 3-3.

STI/BBP Acquisition Logistic Regression. The final model examined the relationship between the subset of youth who tested positive for STI/BBP ($n = 56$) and those who tested negative ($n = 433$). Again, variables from Table 3-3 were entered into logistic regression analysis. All logistic regression analyses reported the estimated logit coefficient, odds ratio, level of significance and 95% confidence intervals for variables entered into the above three models.

Chapter 4

Results

A total of 699 youth participated in both Phase II and Phase III. A total of 27 Phase III participants were deleted from the database because they reported that they had participated in the previous phase of the study. Another 23 youth were also deleted, as they were identified as duplicate respondents. This was determined by reviewing cases with matching dates of birth and genders by name or other variables posed as open-ended questions, such as birthplace, ethnicity, and/or drug preference. In order to maximize the number of biological samples available from duplicate participants, questionnaires with specimens were kept and the earliest participation was used when possible. After removal of the duplicate participants, the resultant sample size was 649 youth.

Demographics

Participants ranged in age from 14 to 24 years with a mean age of 18.02 years ($SD = 2.56$). The study sample had almost equal representation of males ($n = 347$; 53.5%) and females (46.5%). The majority ($n = 619$; 95.4%) of youth were born in Canada, and 40.4% ($n = 262$) of youth identified themselves as first nations people. Most (56.1%; $n = 207$) of the youth stated they had always lived in Edmonton, while another 26.5% ($n = 82$) reported being in Edmonton less than three months.

Social and Perceived Environment

At the time of interview, the majority ($n = 534$; 82.3%) of youth were not living with their parents, with significantly more girls (27.5%) leaving home due to physical, emotional, sexual or verbal abuse compared to boys (19.3%; $\chi^2(1) = 6.073, p < .01$).

Other characteristics of the sample are summarized in Table 4-1.

Table 4-1

Social and perceived environment (N = 649)

Environmental Characteristics	No. of Subjects		
	Male (%) (n = 347)	Female (%) (n = 302)	Total (%) (n = 649)
<i>Living Arrangements</i>			
With parents	64 (18.4)	50 (26.6)	114 (17.7)
Not with parents	283 (81.6)	251 (83.1)	534 (82.3)
Lived in a foster/group home (ever)	194 (55.9)	162 (53.6)	356 (54.9)
<i>*Left home due to abuse</i>			
Yes	67 (19.3)	83 (27.5)	150 (23.1)
No	280 (80.7)	219 (72.5)	499 (76.0)
<i>Parents</i>			
Contacted either parent in last 3 mo.	215 (62.9)	195 (65.0)	410 (63.9)
Either parent ever injected drugs	38 (13.7)	45 (18.8)	83 (16.1)

Note. * $p < .05$ for comparison of male and female respondents.

Self-Esteem

Factor analysis. Exploratory factor analysis was conducted using the 11 self-esteem items administered to the respondents. Principal component analysis was used with varimax rotation. Items loading below .4 were dropped from the table, see Table 4-2. On initial examination of the scree plot, one factor was indicated, accounting for 87.07% of the item variance. Reliability coefficients of the 11 item scale were calculated (Cronbach's $\alpha = .98$). Therefore a new variable, labeled self-esteem, was created from

the sum of the eleven items and this new variable was entered into the models for logistic regression analyses.

Table 4-2

Factor Loadings of Self-esteem Items (N = 649)

Item	Factor Component 1
1. I often wish I were someone else	.97*
2. I have little interest or pleasure in doing things	.97*
3. I am feeling down, depressed or hopeless	.97*
4. No one cares much about what happens to me	.97*
5. I have trouble making up my mind	.97*
6. I am often sorry for the things I do	.96*
7. I have confidence in myself	.96
8. I am a happy person	.96
9. Sometimes I think about committing suicide	.96*
10. I like myself	.80
11. I would change the way I look if I could	.73*
Eigenvalue	9.58
Percentage of Common Variance	87.07
Internal Consistency (Cronbach's alpha)	0.98

Note. *reverse scored items

Behaviour

Delinquency. At the time of interview, the majority (56.9%; $n = 369$) of youth were not registered for school. Some (44.5%; $n = 289$) of the youth had experienced an

absence from school either by dropping out of school or being kicked out of school, with significantly more males (48.1%) reporting an absence compared to females (40.4%; $\chi^2(1) = 3.91, p < .001$). Males were more likely (56.8%) to have been to a youth detention centre or jail overnight or longer than females (37.9%; $\chi^2(1) = 23.06, p < .001$). Table 4-3 summarizes other aspects of delinquency for the sample.

Table 4-3

Delinquency (N=649)

Delinquency Characteristics	No. of Subjects		
	Male (%) (n = 347)	Female (%) (n = 302)	Total (%) (n = 649)
School Attendance			
Currently registered for school			
No	215 (64.6)	154 (52.3)	369 (56.9)
Yes	118 (35.4)	140 (47.6)	258 (39.8)
**Ever absent from school	167 (48.1)	122 (40.4)	289 (44.5)
Criminal System Involvement			
**Been in prison	197 (56.8)	114 (37.9)	311 (48.0)
Not in prison	150 (43.2)	187 (62.1)	337 (52.0)
Ever had a probation officer	189 (54.5)	139 (46.0)	328 (50.5)
Ever had a social worker	226 (65.1)	218 (72.2)	444 (68.4)

Note. ** $p < .001$ for comparison of male and female respondents.

Substance use. Table 4-4 summarizes substance use among the participants. The majority of youth smoked daily (82.7%; $n = 537$) with boys smoking significantly more cigarettes daily ($M = 16.8$) than girls ($M = 13.3$; $t(572) = 3.8, p < .01$). The majority

(87.9%; $n = 517$) of youth also drank alcohol in the last 3 months. Even more (95.7%) youth reported using non-injection drugs sometime during their life and youth reported marijuana as the drug they had used most in the last three months (64.3%). Males reported using non-injection drugs on average 5.7 times a week, more often when compared to females ($M = 4.0$; $t(435) = 2.4, p < .05$). A small percentage (14.6%; $n = 93$) of youth reported using injection drugs sometime in their life, with an average age of first injection of 15.2 years ($SD = 2.9$) and an age range of 9-24 years. Females reported using injection drugs more often in the last three months ($M = 1.57$) as compared to males ($M = 1.14$; $t(75.4) = -2.4, p < .05$). As well, males reported more consistent use of clean injection equipment (96.0%) than females (69.4%; $\chi^2(1) = 6.58, p < .05$).

Table 4-4

Substance Use (N = 649)

Substance Use	No. of Subjects		
	Male (%) ($n = 347$)	Female (%) ($n = 302$)	Total (%) ($n = 649$)
Tobacco Use			
Never	29 (8.4)	33 (10.9)	62 (9.6)
Occasional	25 (7.2)	23 (7.6)	48 (7.4)
Daily	291 (83.9)	246 (81.5)	537 (82.7)
*Mean # of cigarettes per day	16.8	13.3	15.2
Alcohol use in last 3 months			
Yes	281 (81.2)	236 (78.4)	517 (87.9)
No	65 (18.8)	65 (21.6)	130 (12.1)
Non-injection drug use			
Ever used	331 (95.4)	290 (96.0)	621 (95.7)
Never used	16 (4.6)	12 (4.0)	28 (4.3)
Mean frequency of drug use in 1 week	5.7	4.0	4.9
Changes in drug use in last 3 mo. ^a	2.40	2.16	2.3
Injection drug use			
Ever used	45 (13.2)	48 (16.1)	93 (14.6)
Never used	296 (86.8)	250 (83.9)	546 (85.4)
Mean age of first injection	15	15.5	15.38
**Changes in injection drug use in last 3 mo. ^a	1.14	1.57	1.36
*Consistent use of clean injection equipment	24 (96.0)	25 (69.4)	49 (80.3)

Note. * $p < .05$, ** $p < .001$ for comparison of male and female respondents.

^a Variable was measured as a scale where 1=quit, 2=less, 3=same, 4=more.

Sexual behaviour. Most (93.2%; $n = 605$) youth in the sample were sexually experienced, defined as vaginal, oral or anal sexual activities with a male or female partner. The mean age of sexual debut for willing sexual activity was 14.2 years ($SD = 2.04$) with youth becoming sexually active between the ages of 7 to 19 years. The mean age of debut for boys was 13.9 years ($SD = 2.22$) which was significantly lower than females ($M = 14.7$ years; $t(587) = -4.9, p < .001$). Of sexually active respondents, females reported more unwanted sexual activity (25.7%) as compared to males (8.5%; $\chi^2(1) = 32.3, p < .001$). The mean age at which the unwanted sex began was 8.7 years ($SD = 4.5$) with ages ranging from 2 to 22 years. Only 7.4% (9/121) of perpetrators were unknown by the respondents, with foster fathers (19/121) and uncles, grandfathers, and aunts (19/121) being named most often as the perpetrator.

Other differences between males and females included more girls (16.6%) reporting same-sex relationships during the last three months than males (7.0%; $\chi^2(1) = 13.4, p < .001$). Females (17.1%) also reported that they had exchanged sex for money, gifts, drugs or a place to sleep more often than males (9.9%, $\chi^2(1) = 6.7, p < .01$). Together the majority ($n = 49$) of males and females exchanging sex reported using a condom the last time they traded sex.

Table 4-5

Sexual Behaviours (N=649)

Sexual Behaviours	No. of Subjects		
	Male (%) (n = 347)	Female (%) (n = 302)	Total (%) (n = 649)
Ever had sex			
Yes	318 (91.6)	287 (95.0)	605 (93.2)
No	29 (8.4)	15 (5.0)	44 (6.8)
**Mean age at sexual debut	13.86	14.67	14.24
**Unwanted sex (ever)			
Yes	27 (8.5)	74 (25.7)	101 (16.7)
No	291 (91.5)	214 (74.3)	505 (83.3)
Mean age first unwanted sex	9.9	8.2	8.7
Sexual partners in last 3 mo.			
Mean # of partners	2.67	2.43	2.55
Heterosexual	310 (99.0)	281 (99.5)	591 (99.3)
**Same-sex	22 (7.0)	47 (16.6)	69 (11.6)
Type of sexual activity in last 3 mo.			
Vaginal sex	256 (73.8)	230 (76.2)	486 (74.9)
Oral sex	164 (47.3)	131 (43.4)	295 (45.5)
Anal sex	26 (7.5)	15 (5.0)	41 (6.3)
*Exchanged sex for money, drugs, gifts or a place to stay (ever)			
Yes	31 (9.9)	49 (17.1)	80 (13.3)
No	283 (90.1)	238 (82.9)	521 (82.7)
Condom use when last exchanged sex			
Yes	17 (89.5)	32 (91.4)	49 (90.7)
No	2 (10.5)	3 (8.6)	5 (9.3)
Risk of acquiring STI			
No risk	95 (27.4)	70 (23.7)	165 (25.8)
Low risk	169 (49.0)	138 (46.8)	307 (48.0)
Medium risk	61 (17.7)	56 (19.0)	117 (18.3)
High risk	20 (5.8)	31 (10.5)	51 (8.0)
**Tested for STI (ever)			
Yes	146 (42.1)	203 (67.4)	349 (53.9)
No	201 (57.9)	98 (32.6)	299 (46.1)
**Prior history of a STI			
Yes	23 (6.6)	83 (27.7)	106 (16.4)
No	323 (93.4)	217 (72.3)	540 (83.6)

Note. * $p < .05$, ** $p < .001$ for comparison of male and female respondents.

The mean number of sexual partners that youth reported in the last three months was 2.6 ($SD = 6.99$), ranging from 0 to 104 partners. When reviewing the histogram for this variable, the distribution was positively skewed. Consequently, this variable was transformed using the log base 10 to create a more normally distributed curve for variable entrance into logistic regression models. The remainder of the sexual behaviours are summarized in Table 4-5.

Measures of condom use changed between phases; due to the diversity in measurements a common finding among the two phases can not be reported. For this reason, condom use will be reported separately for each phase and was excluded from logistic regression analyses. Some (39.2%; $n = 104$) of the youth participating in Phase II reported always using a condom with all partners (both male and female partners as well as regular and casual partners). Males reported consistent condom use (47.9%) more often than females (29.2%; $\chi^2(1) = 9.6, p < .01$). Phase III questionnaires asked youth if they had used a condom with their last sexual experience with both male or female partners. Contrary to Phase II results, females reported condom use (56.7%) more often than males (27.2%; $\chi^2(1) = 29.1, p < .001$).

Predicting outcomes

Three primary outcomes were of interest in this study: (1) predicting immunization status of participants, (2) predicting agreement to STI/BBP testing, and (3) predicting results of STI/BBP testing. These outcomes were produced using logistic regression analyses, where 32 predictors were simultaneously entered into the regression equation. These predictors represent all five of Jessor's domains in his psychosocial framework. The biological predictors included age, gender, aboriginal status, and being

Canadian-borne. The social environment predictors included having a social worker, ever having lived in a foster or group home, currently living with parents, ever having unwanted sex, and leaving home due to abuse. Perceived environment predictors included having contact with either parent in last three months, and either parent having ever injected drugs. Personality predictors were measured with the newly created self-esteem scale. Behavioural predictors included delinquency measures of ever being in prison, ever having a probation officer, current registration in school, and any absences from school. Substance use measures included tobacco use, alcohol use in the last three months, lifetime non-injection and injection drug use. Sexual behaviour measures included being sexually active, age of sexual debut, number of sexual partners in the last three months, sexual activity with heterosexual or same-sex partners in the last three months, participation in vaginal, oral or anal sex in the last three months, ever exchanging sex, risk level for STI/BBP, prior STI and prior testing for STI.

Predicting Immunization Status. Almost one third (32.7%; $n = 120$) of youth had been immunized against HBV, as confirmed by serology. The relationship between immunization and the independent variables was tested in the initial logistic regression model. Significant results from analyses are reported in Table 4-6. Six of the independent variables predicted immunization status. Respondents who reported using alcohol in the last three months had over a three time greater odds of being immunized than other respondents ($OR = 3.07$; $95\%CI = 1.22-7.70$). Respondents who reported unwanted sex, and respondents who have been in foster or group homes had over two times greater odds of being immunized compared to other respondents ($OR_s = 2.65$ and 2.54 , respectively; $95\%CI_s = 1.08-6.51$ and $1.14-5.68$, respectively). Similarly, youth

who were younger and youth who perceived themselves at less risk for a STI/BBP were also more likely to get immunized compared to other respondents ($OR_s = .68$ and $.63$, respectively; $95\%CI_s = .56-.81$ and $.42-.93$, respectively). Finally, youth whose parents had a history of injecting drugs were less likely to be immunized than other respondents ($OR = .33$; $95\%CI = .12-.93$).

Table 4-6.

Predictors of Immunization Status (n=243)

	B	Wald	Odds Ratio	95.0% CI
Either parent injected drugs	-1.10	4.42	.34*	.12-.93
Alcohol use in the last 3 mo.	1.12	5.68	3.07*	1.22-7.70
Foster/group home (ever)	.93	5.15	2.54*	1.14-5.68
Unwanted Sex	.97	4.49	2.65*	1.08-6.51
Risk for STI	-.47	5.30	.63*	.42-.93
Age	-.39	17.40	.68**	.56-.81

Note. * $p < .05$, ** $p < .001$.

Predicting agreement to STI/BBP testing. The second model examined predictors of respondents' willingness to be tested for an STI/BBP, using the 32 independent variables listed in Table 3-3. Significant predictors of willingness to be tested are presented in Table 4-7. The strongest indicator for youth agreeing to be tested include the number of partners in the last three months ($OR = 5.7$; $95\%CI = 1.53-19.6$). Youth who had left home due to abuse and youth who had spent a night in a detention centre or jail were also more likely to agree to testing compared to other respondents ($OR_s = 2.75$ and 1.94 , respectively; $95\%CI_s = 1.29-5.88$ and $1.01-3.74$, respectively). Detractors from testing

included youth who had been previously tested, younger aged youth, and youth who had participated in vaginal sex in the last three months.

Table 4-7

Predictors of Agreement to STI/BBP Testing (n=415)

	B	Wald	Odds Ratio	95.0% CI
Prison Involvement	.67	3.97	1.94*	1.01-3.74
Tested for STI (ever)	-1.19	13.80	.31***	.16-.57
Left home due to abuse	1.01	6.79	2.75**	1.29-5.88
Vaginal sex x 3 mo.	-1.28	6.48	.28*	.10-.75
Age	-.20	11.54	.82*	.73-.92
# partners x 3 mo.	1.70	6.83	5.48*	1.53-19.6

Note. * $p < .05$, ** $p < .01$, *** $p < .001$

STI/BBP testing. Historically, girls were more likely to have been previously tested for a STI (67.4%) compared to boys (42.1%; $\chi^2(1) = 41.7, p < .001$). Similarly girls were much more likely to have had a prior STI (27.7%) compared to boys (6.6%; $\chi^2(1) = 51.8, p < .001$). During data collection, STI/BBP testing in outreach settings was acceptable to the majority (75.3%; $n = 489$) of street youth who provided either a urine sample ($n = 369$), sera ($n = 356$) or both. Of these youth, a total of 56 (11.5%) youth tested positive for either a STI or BBP. Six of these youth experienced co-infections; 4 youth were co-infected with chlamydia and gonorrhea, one youth had past infection with Hepatitis B with a current case of chlamydia, and finally one youth had HCV and chlamydia. The results of STI and BBP testing are summarized in Table 4-8 and Table 4-

A total of 369 urine samples were obtained. The results from the urine PCR testing found an 11.7% ($n = 43$) prevalence of chlamydia and a 2.2% ($n = 8$) prevalence of gonorrhea. Serology results found a 2.4% ($n = 9$) prevalence of antiHBc indicating previous exposure to HBV. Syphilis testing was added to Phase III serology and no youth were found to have reactive serology.

Table 4-8

Urine Results (n=369)

Urine Results	No. of Subjects		
	Male (%) (n = 207)	Female (%) (n = 162)	Total (%) (n = 369)
Chlamydia	20 (9.7)	23 (12.3)	43 (11.7)
Gonorrhea	4 (2.0)	4 (2.5)	8 (2.2)

A total of 356 samples were provided for storage and future testing of HIV, HTLV, HCV and HSV. Of the 287 stored tubes from Phase II, 2 females tested positive for HCV and no cases of HIV or HTLV were found. Results from Phase III testing have not been released by Health Canada at this time. As well, Health Canada has not made HSV results from either Phase available due to validity concerns of the testing method.

Table 4-9

BBP Prevalence (n=371)

Sera results	No. of Subjects		
	Male (%) (n=191)	Female (%) (n=180)	Total (%) (n=371)
+antiHBs	59 (30.9)	67 (37.2)	126 (33.9)
Indeterminate antiHBs	7 (3.7)	8 (4.4)	15 (4.0)
+anti HBc	5 (2.6)	4 (2.2)	9 (2.4)
+syphilis**	0	0	0
+ HCV*	0	2 (1.1)	2 (1.4)
+ HIV*	0	0	0
+ HTLV*	0	0	0

Note. *Phase II only **Phase III only

Predicting test results for STI/BBP. The final model tested the relationship between testing positive for a STI/BBP in this study and the 32 independent variables. Significant predictors of STI/BBP test results are presented in Table 4-10. The strongest predictor of testing positive for a STI/BBP was having had a probation officer (OR = 3.98; 95%CI = 1.32-11.98). The strongest detractor from having a positive STI/BBP was previously testing positive for a STI (OR = .16; 95%CI = .03-.82).

Table 4-10

Predictors of STI/BBP Acquisition (n =315)

	B	Wald	Odds Ratio	95.0% CI
Probation/parole (ever)	1.38	6.02	3.98*	1.32-11.98
Previous STI	-1.82	4.82	.16*	.03-.82

Note. * $p < .05$

Chapter 5

Discussion

Review of Findings

This is the first study conducted on health determinants related to STI/BBP acquisition among Edmonton street youth in over 11 years. Results from the study confirm that health determinants of Edmonton street youth are similar to other street youth populations and that these determinants place them at risk for acquisition of STI/BBP. The majority of youth who participated in this study were sexually experienced, had multiple partners, and practiced inconsistent condom use. Most respondents used tobacco, alcohol, and illicit (non-injection) drugs, while a minority of respondents reported engaging in injection drug use. Unknown is the number of youth who have engaged in sexual activity while under the influence of substances, when judgement may be impaired further increasing their risk for health consequences. Many of the environmental conditions and behaviours reported by street youth in the present study correspond to theoretically important risk factors for the development of problem behaviour (Jessor, Turbin, & Costa, 1998).

Immunization status. The risk for HBV among street-involved youth is low in Canada, as confirmed by the low (2.4%) HBV rate observed via biological markers in this study. Despite the low rates of HBV observed among street youth in this study, many respondents nevertheless engaged in a number of high-risk behaviours for HBV acquisition including IDU and same-sex relations, thus leaving them at risk for contracting a preventable disease. Therefore, the Canadian STD Guidelines recommend immunization for this population (Health Canada, 1998).

Immunization against a STI/BBP is a successful strategy for control and possible eradication of vaccine-preventable infections. This study examined determinants of HBV immunization among street youth and is the first study in Alberta (to the author's knowledge) to examine how effective the provincial HBV immunization program is in reaching street youth population in Edmonton. Almost one third (32.3%) of the youth in this study were immunized for HBV as confirmed by serology. This is a much higher rate of vaccination than reported in Brazilian (5.4%) and American (8.8%) research (Porto et al., 1994; Alderman et al., 1998). Lower rates in these other studies may be attributed to the lack of universal immunization programs in these jurisdictions at the time of data collection.

In the present sample, one important predictor of immunization was age; younger respondents were more likely to be immunized than older youth. This effect can be accounted for by the provincial grade five HBV immunization program, which was instituted in Alberta in 1995 (with a catch-up grade twelve program in 1999 to immunize those youth missed in the grade five program). This study found a corresponding increase in immunization rates between youth participating in Phase II and Phase III of the data collection (14% versus 42%), suggesting that as HBV vaccine became more available, more youth were immunized.

Several other significant predictors of immunization status reflected aspects of youths' environments. First, living in a foster or group home was positively related to HBV immunization status. The author originally hypothesized that youth living with their parents would be more likely to be immunized because these youth would be more likely to attend school and be reached through school-based immunization programs.

The present results suggest, in contrast, that street youth's home environments are not as health promoting as hypothesized and that health promoting behaviour occurred among youth who had left home. Because most (82.3%) of the youth in this study were not living with their parents at the time of data collection and the majority (54.9%) of study respondents had lived in a foster or group home, one explanation for these findings is that youth may have found alternative and more stable living arrangements outside of their parental home. The foster or group home may have provided youth with opportunities to practice health promoting behaviour, such as immunization, by creating a stable environment and reconnecting youth to traditional programs, offered via school.

Youths' perceived environment also affected their likelihood of being immunized. Specifically, youth who reported that their parents had injected drugs were less likely to be immunized. These results suggest that parental role modeling of risk behaviour may have negatively impacted respondents' disease prevention behaviours. These results suggest that future studies on this issue should include other measures of role modeling in relation to drug use and other behaviours among parents and peers.

An additional finding with respect to youth's environments was that Edmonton street youth who had experienced unwanted sex were more than 2.5 times more likely to be immunized than street youth who had not reported unwanted sex. One possible explanation for this finding is that because the mean age of unwanted sex was 8.7 years, the unwanted sex may have occurred while youth were still living at home. Once disclosed, the youth may have been apprehended and placed into care where they benefited from a more health-promoting environment. A disturbing finding was that among youth reporting unwanted sex in Phase III of the study, the most common

perpetrator named was their foster father. This suggests that street youth who were placed in foster care for their protection had once again been victimized.

Another possible explanation for why youth who have had unwanted sex are more likely to be immunized is the standard health practice for sexual assault cases. If the unwanted sex was a result of rape and the youth presented to the emergency department for medical care, administration of hepatitis B immune globulin followed by immunization for HBV is standard practice in the prevention of HBV acquisition (Sinclair, 2000).

Another intriguing finding of this study was that youth reporting recent alcohol use were more likely to be immunized than youth who did not report recent alcohol use. The author is not aware of any obvious reasons for this finding. This finding requires further investigation to determine the validity of the measure and, if valid, to understand its relationship. One possible explanation may be that the alcohol use reported was by younger street youth, who were found to be more likely to be immunized. If alcohol use is an entry level substance for youth's substance abuse, then its use would be more prevalent among younger street youth. Another possible explanation for this finding may be that alcohol use is more reflective of mainstream youth practices. It is a legal substance and therefore is seen as less deviant, thus youth using alcohol may be more tied to community norms and engage in health promoting behaviour.

A final predictor for immunization was youths' perceptions of their risk for STI/BBP acquisition, such that lower perceived risk was related to higher likelihood of being immunized. This result is consistent with trends in health prevention where the early adopters practice health promotion behaviours and those at highest risk remain

hardest to reach with traditional programs and require efforts to overcome barriers (Oldenburg, Hardcastle & Kok in Glanz, Lewis, & Rimer, 1997).

Agreement to testing. Many STI/BBP are asymptomatic, thus making it difficult for people to recognize when they are infected and when they should seek treatment. In order to identify cases, testing is an integral step in STI control programs. Rietmeijer, Bull, Ortiz, Leroux, and Douglas (1998) found a lack of STI testing among sexually experienced street youth, with 72% accessing general health services but only 34% of them receiving STI evaluation. Only 14% of youth identified local STI clinics as a source of STI services. One strategy to address this problem is making testing accessible to high-risk youth through outreach testing, taking testing services to locations where youth congregate.

In the present study, most (75.3%) youth found outreach testing acceptable. A strength of the study design adopted by the Edmonton site was that compensation for participation in the study was tied only to the completion of the questionnaire. This removed any monetary incentive for testing from the youth's decision. Of those youth who agreed to testing, two of the predictors were behavioural, being in jail and having multiple partners. Although being in a detention centre results from delinquent behaviour, a health promoting behaviour may have been inadvertently created. This study found that youth who have been in a detention centre were almost two times more likely to get tested. This may be due to a familiarity with health services that youth had acquired during their detention and therefore the recognition of a non-invasive testing method. As well it may be related to high-risk behaviour practiced by this population, like sharing equipment for tattooing or drug use, and their desire to be tested.

A second behavioural predictor of agreement to testing was youth who had multiple sexual partners in the last three months, these youth were also more likely to get tested. Youth may perceive that having multiple partners may increase their risk for exposure to STI/BBP (Noell et al., 2001a & b) and therefore they recognize the benefit of testing.

One surprising finding was that youth who had left home due to abuse were more likely to agree to testing than other youth. One possibility is that these youth may have been removed from their homes due to abuse and placed in care, which possibly provided a more supportive environment, which in turn facilitated openness to being tested.

Another unexpected finding was that youth who had recently had vaginal sex were less likely to get tested. Further investigation into the context of the vaginal sex including the type of partner and length of relationship would be helpful in interpreting this finding.

This study also found that younger respondents were more likely to agree to be tested than older respondents. This result is contrary to Goodman & Berecochea's research (1994) which found older youth were more likely to be tested for HIV.

Similarly, the result is contrary to the author's original hypothesis, namely, that older youth would be more likely to be tested. It was hypothesized that older youth would have greater sexual experience than their younger peers; older youth would then perceive themselves as more at risk for STI/BBP acquisition and recognize the need for testing. This hypothesis may be true in part, if older youth were the respondents who stated they had been previously tested. This variable was the most significant detractor from getting tested in the study. If the majority (53.9%) of youth who reported being previously tested

were older youth, they may not recognize the benefit of repeat testing if they recently had been tested, have had no recent exposure or remain with the same partner.

STI/BBP prevalence. This is the first study measuring STI prevalence among Edmonton street youth in over 11 years and the author believes the first study to measure BBP prevalence. The global prevalence rate for available STI/BBP results was 8.4% (62/740). These rates confirm a high prevalence of STI/BBP infection among street youth and support theories that street youth act as a core group for STI/BBP transmission. The global prevalence rate may also be an underestimate of the true incidence of infection as 16.4% of participants reported previously acquiring a STI/BBP.

This study's prevalence rate of 11.7% for chlamydia and 2.2% for gonorrhea is higher than rates reported in other Canadian jurisdictions (Poulin et al., 2001; Haley et al., 2002; Noell et al., 2001b). The chlamydia prevalence is also higher than the national prevalence of 8.8% from Phase II results reported by Health Canada (2003). The last study in Edmonton reported even higher prevalence rates of 24.1% for chlamydia and 14% for gonorrhea among their total study population which included juvenile prostitutes, street youth and control populations (Rouget et al., 1994). Differences between the studies include a smaller sample size ($N = 137$) in Rouget et al.'s study with about a quarter ($n = 35$) of the sample being non-sexually active and recruitment of street youth and prostitutes occurring within an involuntary setting. When prevalence rates were extracted for the street youth subpopulation, chlamydia rates dropped to 8% (3/36) and gonorrhea rates remained higher at 6% (2/36).

A final study of chlamydia prevalence in Canada was by Tam et al. (1996). They reported a lifetime chlamydia prevalence rate of 22% ($n = 22$) among their street youth

population as confirmed through serotesting. The discrepancy between this study's rate and Tam et al.'s may be explained by testing methods: the PCR urine test reports point prevalence, while serotesting reports lifetime infection.

Other STI prevalence rates included zero cases of syphilis and 2.4% rate of past HBV infection. With the majority (95.4%) of the study population born in Canada, these rates are consistent with the time period of data collection where cases of syphilis in the Edmonton region were immigration-related (1.2/100,000) and HBV had low endemic rates in the community (1.8/100,000; Predy et al., 2003). A HCV prevalence rate of 1.4% is lower than HCV rates reported by two other studies (Roy et al., 2001, 12.6%; Noell et al., 2001b, 3.9%) and lower than the 2.2% rate found nationally in Phase II (Health Canada, 2003a). These three studies included much higher IDU populations than this study; Roy et al. reported nearly one half (45.8%) of their youth were IDU, Noell et al. reported one third (37.1%), and the national average for Phase II was one fifth (20.2%) of respondents.

Our final logistic regression model set out to determine predictors for STI/BBP results among street youth. Results showed that youth who had probation officers were almost four times more likely to be positive for a STI/BBP. This finding is similar to Sweeney et al.'s (1995) study, which reported a higher rate of HIV seropositivity among youth in correctional facilities compared to their other recruitment sites (0-6.8% vs. 0-4.1%). This higher risk for STI/BBP acquisition may be associated with behaviour related to the offenses committed by youth. Drug related offenses have associated risk behaviours, like IDU and sex trade, which place youth at risk for STI/BBP acquisition.

Another interesting finding of STI/BBP serotesting results was that youth who had a previous STI were 84% less likely to be positive for a STI/BBP when tested in the study. This is generally consistent with the literature reviewed on STI prevalence, where only one study (Alderman et al., 1998) reported an association between lifetime history of chlamydia and HBV acquisition. Youth, who have acquired personal experience with STI, may become aware of their risk and motivated to make changes to their behaviour.

Psychosocial framework. Jessor's Problem Behaviour theory was partially supported by the study results. Two of the models tested (immunization status and agreement to testing) found support across four of the domains proposed by Jessor to be influences on problem behaviour (see Figure 4). Specifically, results of the immunization and testing analyses supported Jessor's view that the domains of biology/genetics, perceived environment, social environment and behaviour predict risk and protective behaviour. The perceived environmental factor, either parent injecting drugs, suggests that these parents are role models for deviant behaviour. Youth leaving home due to abuse is described as conflict in the social environment and youth who stay in this environment are less likely to be involved in health promoting practices like immunization. Removal from this environment and placement into a supportive environment (like foster or group homes) reconnects youth to community programs like school and health. These findings suggest that the role of the social environment plays strongly in the youth's health promoting behaviour in terms of immunization and testing.

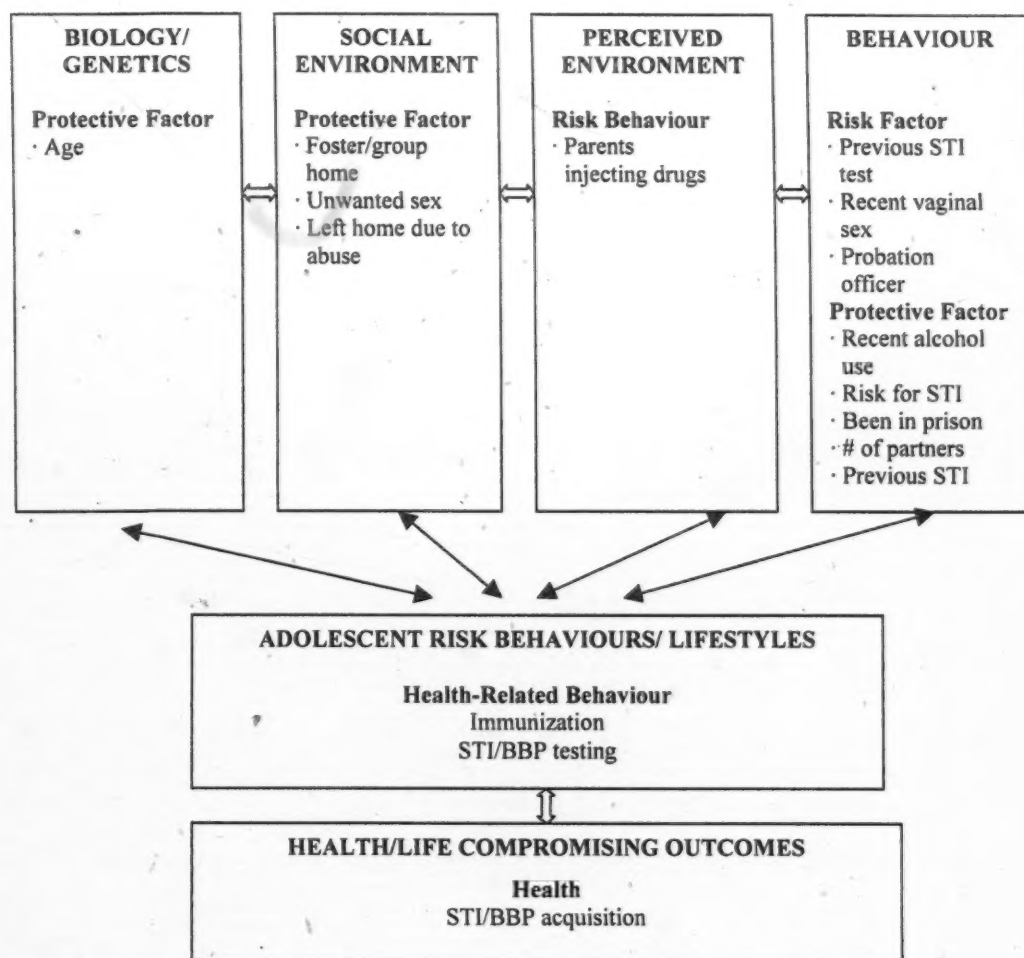


Figure 4. Study results in Jessor's psychosocial framework.

In terms of Jessor's theory, the behavioural domain was the most consistent predictor of study outcomes, accounting for seven of the fourteen significant predictors across the three regression models. Predictors of STI/BBP acquisition were solely limited to behavioural factors (previous STI and having a probation officer). This is not surprising since much of the literature reviewed previously focused on behavioural aspects of STI prevention, with certain behaviours being linked directly as a mode for STI/BBP transmission, like IDU and HCV.

The one domain not supported by these results was the personality domain. This exception may be related to the study's limited measure of personality with only one variable entered into logistic regression analyses, the self-esteem scale. Future research may wish to include other personality determinants, as theories on protective factors have been popular when working with at-risk populations (Health Canada, 1997b).

Limitations of the Research and Future Studies

Several overall limitations of this study should be noted. Most of the data collected in the study used self-reports, the most common method used in studying street-involved youth. To encourage openness among respondents' answers, the questionnaire was anonymous and youth were only linked by a subject identification number known only by the research nurse. As well, youth were interviewed one-on-one by the study nurse to ensure confidentiality of answers. However, due to the sensitive nature of topics in the questionnaire, such as child abuse, prostitution or illicit drug use, youth may underestimate their involvement in these activities.

Another study limitation was sample representativeness. It is extremely difficult to establish population characteristics of street youth, due to the transient nature of the population, and the lack of an accurate estimate of population size. An attempt to ensure representation among Edmonton street youth was made by using a variety of recruitment sites serving street youth across north, south, and central Edmonton. Recruiting youth from community based organizations (CBO) introduces its own potential selection bias, as youth not accessing these services are excluded from participation. Street youth accessing CBO have a degree of community awareness. Both street youth disengaged from the community and not aware of available resources to assist them and youth

banned from a CBO for participating in behaviours that are not sanctioned by the centre, like prostitution or drug trafficking, would be populations missed by this study.

Immunization status. Interpretation of the role of alcohol use and immunization would be facilitated by further investigation. For example, future studies could further explore the validity of the measure of recent alcohol use. With the majority (87.9%) of youth reporting recent alcohol use, what is the difference between youth who reported use and those who didn't? One possible difference between these youth may be that youth who reported not using alcohol may have restricted environments, like prison, where alcohol is difficult to obtain compared to other substances. Exploring the relationship between environment and behaviour may provide us with greater insights for the future.

Another consideration in interpreting these results is that the universal HBV program began in 1995 and was not available to most of the study's participants. For the majority of the study population, the traditional HBV program of having high-risk people identify themselves for immunization was their only access to immunization and did not provide coverage to most of the study population. Future studies may provide greater insight into factors related to the success of the school-based program in reaching street youth, being mindful that many youth report absences from school.

Agreement to testing. A possible limitation in the analyses of youth agreeing to be tested may be that analyses did not account for the difference between youth who agreed to the less-invasive urine test as compared to the invasive blood test. One of the heralded advantage for chlamydia and gonorrhea testing was the development of the urine PCR. Being a less invasive testing method than traditional swabbing techniques,

testing may be more desirable to clients and an increase in willingness to be tested was expected. As well, urine based testing allowed testing services to be extended to non-clinical settings, increasing the accessibility of testing.

Future research should also explore the relationship of abuse and youth's recognition of the importance of being tested. This study's exploration of abuse issues were limited to a compilation of physical, verbal, emotional, and sexual abuse as reasons for leaving home. Further exploration is needed to understand what elements of living at home place youth at risk for health consequences and what is required for youth to have a supportive home that encourages health promoting behaviour.

Similarly, future studies should examine the role that vaginal sex plays in youths' detraction from getting tested, especially as the majority (74.9%) of youth have participated in vaginal sex in the last three months. Investigation could inquire into the context around the vaginal sex, including the type of partner, the relationship to that partner, and the perceived risk of vaginal sex as compared to other forms of sexual activity.

STI/BBP Results. The urine collection method of the study may have led to an underestimation of chlamydia and gonorrhea prevalence rates. Manufacturers of the PCR testing recommend collection of a 2-hour post-void urine sample. During data collection, the time of last void was not assessed and urine samples were collected without this consideration. Implementing this requirement could impact recruitment, as requesting up to two hours of a youth's time could be perceived as a barrier both to study participation and testing. Another factor that may impact the estimation of STI rates is recent antibiotic use by youth. Antibiotics used for common health concerns may be the same

antibiotics used to treat STI, therefore the STI is treated but never diagnosed by the health care practitioner or recognized by the youth.

Another limitation to these analyses is the inability to include all positive results in the logistic regression model. HSV-II results were not available from Health Canada for Phase II and III, as well as HIV, HTLV, and HCV results from Phase III. Two other street youth studies estimate the HSV-II prevalence to be 8.2% (Noell et al., 2001a; Rhode et al., 2001). Using these estimates, our study would have potentially missed an additional 30 youth with STI which may have impacted our results from the logistic regression analyses.

Another limitation to this study's analyses was that disease specific logistic regression was not possible due to the low case numbers of gonorrhea, HIV and HCV. Although all of the infections entered into the model can be acquired through sexual transmission, behaviours known to be associated with disease transmission and acquisition, like HCV and IDU, were not found to be significant. Future studies following street youth as a cohort, if feasible, would be of great interest for BBP acquisition, as older age is associated with HIV and HCV acquisition (Dematteo et al., 1999; Roy et al., 1999 & 2000).

A final limitation to this model was that condom use was not entered into the model. Condom use is an important tool in the prevention of STI acquisition, though its success is greatly dependent on consistent and correct use. However, the impact of this limitation may be minimal as the results found that the majority of street youth practice inconsistent condom use and condoms are not effective against BBP acquisition when the mode of transmission is injection.

Health Promotion Implications

Overall, this study has met its four objectives. It has confirmed that STI are more prevalent among Edmonton street youth than other street youth participating in the study nationally. It has also examined variables that place youth at-risk for STI/BBP acquisition and has examined predictors for two main strategies in STI prevention and control, immunization and testing. Some of Edmonton's street youth are being immunized and the majority of youth are in favour of being tested. As health care providers, we need to continue to support these health promoting behaviours by maintaining their accessibility to street youth and that may be accomplished by delivering comprehensive outreach services to youth at locations where they congregate.

Immunization status. An increase in immunization rates among younger street youth is a positive sign for the Alberta immunization program. Despite this positive sign, the majority (77.3%) of the youth in the study were not immunized and therefore were not reached by previous HBV programs which targeted high-risk populations. The lack of HBV immunization among this sample confirms the need for developing creative ways to reach this population. To address the need for HBV immunization among Montreal street youth, Haley, Roy, Belanger, and Crago (1998) describe an outreach style HBV immunization program, where dosing schedules were shortened to 0, 1, and 4 months. They found 79.1% ($n = 383$) of youth completed 2 doses of the vaccine and 50.4% of youth completed all 3 doses of the vaccine.

In Edmonton, three of the recruitment sites provided HBV vaccine to youth through outreach services. This service is provided by nursing staff who visit the recruitment sites regularly and provide vaccination as well as other healthcare services.

This service may play an important role in catching youth who have been missed in the current school-based program as 44.5% of youth reported an absence from school.

Evaluation of this service may be of interest to future researchers.

Outreach Testing. Support for outreach STI/BBP testing has also been found in other studies (Rietmeijer et al., 1997; Gunn et al., 1998; Jones, Knaup, Hayes, & Stoner, 2000; Van den Hoek, 1997). Rietmeijer et al. (1997) provide strong support for outreach testing as they reported higher chlamydia rates among youth screened in the field as compared to those screened in a facility (11.9% vs. 4.4%, $p < 0.05$). Further support for outreach testing is provided by Jones, Knaup, Hayes, & Stoner (2000) who outline the benefits from partnering with CBO. First, the CBO are able to increase service to clients for no extra cost. Second, providing outreach service at CBO created an increased sense of partnership between researchers and community. Finally, CBO provided a stable contact point for many clients, which may help with notification processes.

This final benefit has the greatest practice implication as the ability to locate clients after testing to provide treatment and follow-up is critical to the success of an outreach-testing program. The difficulty in locating this population is illustrated by this study's nurses only being able to locate and treat 38% (9/47) of individuals with chlamydia and gonorrhea. One of the challenges the nurses faced was delays of up to one month for results from the laboratory. Future studies need to address the turn around time of results and to develop communication strategies with youth on how best to return results to a highly mobile population. One solution may be the development of point of care testing with preliminary results available on site to treat youth with presumptive diagnosis.

A strength among a subpopulation of street youth emerged; youth involved in the prison system self-identified the need for testing. Recent reports on HIV and HCV rates in Canadian prisons found staggering rates among the prison population (Correctional Services of Canada, 2003). This high rate of infection was also confirmed in this study when youth who have had probation officers had a four times greater chance of acquiring a STI/BBP. Once released, persons involved in the criminal system have the potential to spread infections to the community acting as another group of core transmitters. Recognizing that youth who have been in detention centres and are coming forward for testing is a behaviour that should be supported by health care providers. Continuing to support easily accessible testing for these individuals should be a priority for health care providers.

A final implication for practice was that youth who had previously been tested for a STI/BBP were less likely to get tested. If street youth are a core group of STI transmitters, then regularly testing for STI/BBP will be very important for identifying cases. The Centers for Disease Control and Prevention (2002) supports the need for repeat testing and recommends rescreening all youth with positive chlamydia to ensure the infection has resolved. As well, further investigation is needed to determine why older aged youth were less likely to be tested, especially as many studies have found older age associated with STI/BBP acquisition (Dematteo et al., 1999; Ochnio et al., 2001; Roy et al, 1999 & 2000).

STI/BBP results. A final strength of street youth was highlighted when youth who had a previous STI/BBP were less likely to be positive in this study. This is good news for health practitioners as repeat infections with some STI can lead to severe health

consequences like infertility. Future studies should examine this predictor further to determine whether these youth have undergone behaviour change that is leading to disease prevention and if so how this change can be supported.

Conclusion

This study confirms that many Edmonton street youth are participating in high-risk activities for STI/BBP acquisition. This study also confirms that Edmonton street youth have a higher rate of STI prevalence in comparison to similar street youth populations surveyed nationally. With participation in high-risk behaviours and high prevalence rates, health care providers need to address these issues if they are to successfully control and prevent the spread of STI/BBP. Immunization and testing are two strategies that were found acceptable by street youth and can be delivered through an outreach setting.

Immunization is an effective prevention strategy against STI acquisition. This study confirmed that immunization was more likely for younger youth who may have benefited from universal school-based programs. Unfortunately, older youth have not been reached and the need for outreach service that includes HBV immunization continues. By developing a successful HBV immunization program among street youth, we will be well prepared for future vaccine development and initiation.

The next strategy in STI control is identification of cases to begin treatment and partner notification. Similarly, outreach services may assist in reaching core transmitter groups by making testing services accessible. A challenge to this strategy is encouraging youth who have been previously tested that routine (rather than a single-shot) testing regimen is required. Another challenge with the current system is the time between

testing and results which adds the challenge of locating, often mobile, youth for treatment. The development of point of care testing will greatly benefit the speed in which STI can be treated. To assist us in targeting our interventions to those most in need, the final analyses provided insights into who is most at risk for STI/BBP acquisition. Through a combination of support, education, and access to services, the prevention and eradication of STI/BBP may be possible.

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Appendix 1

Search Terms

Search Term	Medline	CINAHL	Psych INFO	Ovid Health Star
Homeless Youth	Classification Education Ethnology History Legislation and jurisprudence Psychology Statistics and numerical data	N/A	Keyword	Classification Education Ethnology History Legislation and jurisprudence Psychology Statistics and numerical data
Street youth	Keyword	Keyword	N/A	Keyword
Runaways	N/A	Etiology Psychsociology	N/A	N/A
Sex Behaviour	Chemically induced Classification Drug effects Education Ethnology History Physiology Physiopathology Psychology Radiation effects Statistics and numerical data	Drug Effects Education Ethnology Ethical issues Epidemiology Evaluation History Legislation and Jurisprudence Nursing Prevention & control Sexuality Trends	Psychosexual behaviour	Classification Drug effects Ethnology History Physiology Psychology Radiation effects Statistics and numerical data
Sexually transmitted diseases	Blood Cerebrospinal fluid Chemically induced Classification Congenital Complications Diagnosis Drug Therapy Economics Education Ethnology Enzymology Epidemiology	Blood Complications Diagnosis Drug therapy Economics Education Ethnology Epidemiology Etiology History Legislation and jurisprudence Microbiology Nursing Prevention &	Venereal diseases	Blood Classification Congenital Complications Diagnosis Drug therapy Economics Ethnology Enzymology Epidemiology Etiology Genetics History Immunology Metabolism

Search Term	Medline	CINAHL	Psych INFO	Ovid Health Star
	Etiology Genetics History Immunology Metabolism Microbiology Mortality Nursing Pathology Prevention and control Physiopathology Parasitology Psychology Radiography Rehabilitation Radiotherapy Surgery Therapy Transmission Urine Veterinary Virology	control Psychosocial factors Pathophysiolog y Risk factors Symptoms Trends Therapy Transmission Urine		Microbiology Mortality Nursing Pathology Prevention and control Physiopathology Parasitology Psychology Radiography Rehabilitation Radiotherapy Surgery Therapy Transmission Urine Virology

Appendix 2

**INFORMATION SHEET
ENHANCED STD SURVEILLANCE IN CANADIAN STREET YOUTH****INVESTIGATOR: DR. GERRY PREDY****PURPOSE:**

You are being asked to take part in a Health Canada research study which will gather information on the sexual health of Canadian street youth. Health Canada wants to determine 1) how prevalent sexually transmitted diseases (STDs) are among street youth and 2) what makes street youth at risk for STDs. This information will be collected through two visits with a research nurse. Part I will include a questionnaire and lab testing. Part II will be a questionnaire and the results of your lab tests. Street youth will be interviewed from five Canadian cities and the results will assist in the developing future prevention programs.

PROCEDURES:

The research nurse will review this study with you and obtain your verbal consent if you choose to participate. When you agree to participate in this study you will receive a \$10.00 food voucher¹.

PART I: The research nurse will verbally review a questionnaire with you asking about your personal life including your sexual behavior. Once completed the research nurse will obtain a urine sample from you for chlamydia and gonorrhea, as well as 2 tubes of blood (1 to test for Hepatitis B and syphilis and one without your name on it). These will then be forwarded to the Provincial lab for testing. The nurse will talk to you about returning to the same site to receive your results at a later date.

The tube of blood without your name will be stored at the Provincial Lab. It may be tested for HIV, and Hepatitis C, herpes virus, or HVL T at a later date. Because your blood will be stored without information linking it to you, the results of these tests will not be available to you. If this is done, further ethics approval will be sought.

PART II: During your return visit the research nurse will review your results with you. If you test positive for gonorrhea, chlamydia or syphilis, you will receive treatment. If you test positive for Hep B the nurse will discuss with you what that means. By law, any positive chlamydia, gonorrhea, syphilis and Hep B results must be reported to the public Health Doctor by name. Strict confidentiality is maintained when reporting these results. The nurse will also discuss with you and why you returned for your results and ask about your sexual partners (This is called contact tracing and is done to make sure that anyone else who may be infected receives treatment).